REPORT RESUMES

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TO TEST REFINEMENTS IN INTRINSIC PROGRAMING IN PICTORIAL, AUDIO, AND PERFORMANCE FRAMES TO MAXIMIZE THE PROBABILITY OF DESIRED TERMINAL BEHAVIOR.

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A SERIES OF SEVEN STUDIES WAS CONDUCTED CONCERNING FACTORS IN BRANCHING (PROGRAMED INSTRUCTION), USING SIMULATION TECHNIQUES OF PICTORIAL OR AUDIO STIMULUS FRAMES AND OF PERFORMANCE RESPONSES. USING VARIATIONS OF THREE OF THE FOUR PROGRAMS ORIGINALLY WRITTEN TO INSTRUCT COLLEGE JUNIORS AND SENIORS IN THE USE OF THE UNIVERSITY LIBRARY, THE STUDIES WERE DIRECTED TOWARD THE INTRODUCTION OF SIMULATION TECHNIQUES INTO THE PROGRAMS. THE GOAL WAS TO INCREASE THE PROBABILITY OF ACHIEVING THE DESIRED TERMINAL BEHAVIOR. THERE WERE TWO TYPES OF SIMULATION USED--(1) COLOR PHOTOGRAPHS WERE INCLUDED IN EVERY INSTRUCTION FRAME, COMBINED WITH RELEVANT VERBAL INSTRUCTION IN PRINT, AND (2) PERFORMANCE FRAMES AT A NUMBER OF POINTS IN THE PROGRAM REQUIRED THE LEARNER TO STOP THE PROGRAM AND PERFORM CORRECTLY A TASK BEFORE CONTINUING WITH THE PROGRAM. ALL SUBJECTS RECEIVED A PRETEST FORM OF A CRITERION TEST. SUBJECTS WERE ASSIGNED TO THE TEACHING MACHINE 1-3 WEEKS AFTER THE PRETEST. FOLLOWING THE PROGRAMED INSTRUCTION, THE POST-TEST WAS ADMINISTERED. IN ADDITION TO A REVIEW OF THE VALIDITY OF PERFORMANCE FRAMES, THIS REPORT DESCRIBED SEVEN DIFFERENT EXPERIMENTS INVOLVED IN THE STUDY SERIES. THE RESEARCHERS STRESS THAT CARE MUST BE TAKEN TO MAINTAIN THE NEED FOR ACADEMIC RECOGNITION BY MAKING PROGRAMED INSTRUCTION AN INTEGRAL PART OF COURSE ASSIGNMENTS. (JC)

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Final Report
on
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U.S.O.E. Grant No. 7-23-0907-189
Made Under Provision of Title VII
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Education Act of 1958

Submitted by
Southern Illinois University
Educational Media Research Center
Carbondale, Illinois
September 30, 1965

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We herewith transmit the Final Report on Research Conducted Under U.S.O.E. Grant # 7-23-0907-189 Made Under Provision of Title VII of Public Law 85-864 Known as The National Defense Education Act of 1958.

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GENERAL EXPERIMENTAL ASPECTS

The studies reported herewith are an extension of the series of research studies reported at the conclusion of USOE Grant No. 7-11-076.00 under the provisions of the NDEA Title VII.[1] Most of that series and all of the present series of studies were concerned with factors in branching programed instruction using simulation techniques of pictorial or audio stimulus frames and of performance responses.

The studies used variations of three of the four programs originally written to instruct students in the use of the university library. From the beginning the intention was not merely to experiment with techniques of branching programed instruction such as by-passes, review circuits, and parallel lines of instruction, but to introduce into the programs simulation techniques in order to increase the probability of achieving the desired terminal behavior in the learner. Two types of simulation were used. First, color photographs were included in every instruction frame combined with relevant verbal instruction in print. Rust[2] validated the use of these pictures. Second, at a number of points in the program performance frames required the learner to stop the program temporarily and perform correctly a task in the learning room before continuing with the program. For example, the learner was requested in one program to look up a catalog card in a card catalog tray on the table before him. Until he found the correct card, he was unable to continue with the program.

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[1] Wendt, McCoy, and Rust, "A Study to Determine the Extent to Which Instruction to University Freshmen in the Use of the University Library Can Be Turned Over to Teaching Machines." USOE Grant No. 7-11-076.00 made under Provision of NDEA Title VII.

[2] Grosvenor Rust, "A Study to Explore the Effectiveness of Color Photographs in Intrinsically Programed Automated Instructional Materials." To be published. USOE Grant No. 7-23-0907-157.0 made under Provision of NDEA Title VII.

Laboratory Facilities of the Learning Media Research Center.

The materials, equipment, and facilities used in the present series of studies were virtually the same as those used in the previous series. For greater flixibility in making revisions and for greater visual impact, the program frames were presented on the screen by means of 2 by 2 slides. The subject was seated in a dark, quiet, air-conditioned room approximately 6 by 12 feet. Each frame and each answer in a multiple choice diagnostic question directed the student to another frame. The student accomplished this move by pressing numbered buttons on a control panel on his desk. These buttons controlled the random-access Sarkes-Tarzien slide projectors in a projection booth (previously three projectors were used, but experimental modifications in the programs extended their length and required the addition of a fourth projector). In the audio experiments, the control panel also controlled the Teleprompter Digital Tape Recorder (random-access tape player).

Another modification of the equipment was to replace the Esterline-Angus data recorder with a print-out device adapted from a Victor adding machine which recorded the numbers of all the frames used by each individual student and the time spent on each frame.

Programs

Four programs were originally written to teach freshmen students how to use the Morris University Library. The Fourth program (how to use dictionaries and encyclopedias) was omitted in the present series of experiments because only a limited number of criterion test questions could be designed to test subjects' knowledge of the program content. This limited number of questions was not sufficient for research purposes.

The content of the three programs used for this report is summarized below:

1. the author-title card catalog (author cards and title cards)
   the subject card catalog
   special alphabetizing methods

2. The Dewey Decimal System
   the call number
   how to locate and check out books

3. locating periodical's titles in the card catalog
   how to find periodicals on the shelves — Later program 3a
   check out rules regarding periodicals
   Readers' Guide author entries
   Readers' Guide subject entries — Later program 3b
   interpretation of the Readers' Guide entries

Several program modifications were required for this second series of studies.

a) Updating the frames describing check-out procedures to conform with the modernized computer system.

b) The insertion of performance frames in Program 3, the only program of the original four which did not contain them.

c) The insertion of by-passes in Program 1 which originally did not contain them, and the addition of new by-passes and revision of old ones in Programs 3a and 3b.

d) The elimination of short review circuits at the beginning of the Programs 2 and 3 about the previous program. The addition of more comprehensive review circuits at the end of Programs 3a and 3b.

e) The division of Program 3 into 3a and 3b to accomodate the new performance frames, by-passes and review circuits without making any single program seem unduly long to the subjects.

The research described here used Program 2 only in the initial experiments because it was found that the subject population (college Junior and Seniors) already knew most of the material presented in this program.

Criterion Test.

The criterion acheivement test, a paper-and-pencil test, was statistically improved in four revisions. The content validity was established against professional librarians and concurrent validity against criterion tasks performed by the subjects in the library. The reliability as tested by Kuder-Richardson formula 20 ranged from .76 to .83.

Subjects.

The samples of subjects in the present series of studies were drawn from the beginning course IM 417 in the Instructional Materials Department of the College of Education. This course is predominately composed of Juniors and Seniors with a few graduate students. The highest percentage, 38.6%, of the students enrolled at Southern Illinois University come from Southern Illinois (perdominately rural areas and small cities plus the East St. Louis area) and 27.6% of the students come from the metropolitan Chicago area (Lake, Cook, Dupage, and Will counties). Approximately 22.4% of the students come from the central and northern regions of Illinois (excluding the Chicago area), 9.2% of the students come from out of state, and 2.2% of the students are from other countries. This distribution of the population seems to be normal for a major state university.

Appr. 35/7/5 10

Seven IM 417 sections of 35 students each provided ample subjects every quarter for the experimentation. This course required a knowledge of programed instruction and also a knowledge of the use of the library; the final examination contained questions about both. Students were required to go through the programs. The Hawthorne Effect was minimized inasmuch as the students were not told that this was an experiment and all considered it a normal assignment in the course. They usually were not aware that their individual program patterns and time spent on each frame were being recorded.

Performance Rating Scale.

One of the most valuable principles of programed instruction is determining in advance the terminal behavior desired from the learner. Similarly, the effectiveness of the program, whenever possible, should be evaluated by the learner's terminal behavior. In most situations the experimenter must be content with a purely verbal, paper-and-pencil test and run the risk of having the learner be able merely to regurgitate the verbal learning but be quite unable to put the learning into practice.

Fortunately in the programs on the use of the library, the terminal behavior desired--using the library efficiently--was directly measurable in action. A series of assignments were devised which required the subject to go out on the floor of the library and demonstrate that he was able to apply what he learned in the program. For example, he was asked to find catalog cards in the library's main Card Catalog,to locate books on the open shelves, to look up references in the Readers' Guide, and to find periodical articles.

A Performance Rating Scale was derived to rate the subject on each task and on the steps involved in each task. (See Appendix A).

In practice the subject was given a list of assignments to carry out in the library, the experimenter accompanied him during the entire performance of these assignments, noted his movements and decisions, and noted these on the Performance Rating Scale. A score was obtained for each subject on each task by adding his scores for each step of the task.

The items in the Performance Rating Scale and their weights were based on data obtained from the behavior of 90 subjects who were rated on two prior versions of the Rating Scale. Face validity of the Rating Scale was obtained from the Southern Illinois University professional librarian assigned to the projects advisory staff. The Performance Rating Scale correlated +.05 with the criterion pretest and +.65 with the posttest.

Experimental Procedure

The following general procedure was used for the studies conducted for this report. Specific studies have slight variations. All subjects received a pretest form of the criterion test administered in the classroom by the class instructor. This test was given sometime during the first three weeks of the term. All classes received the test within three days of each other. Subjects were informed that the test was to help the instructor determine the strong and weak points of the class regarding their knowledge of the library so that he could plan the section of the course regarding the library around these strengths and weaknesses. Subjects were told that the test scores would not affect their grades.

The Reading Comprehension Test and the 16 Personality Factor Test when used were also usually administered by the classroom instructor. Generally these tests were also administered as close to the beginning of the term as possible. The classroom instructor told the subjects that these tests were part of a survey so that they would not associate the tests with the programed instruction given later in the course. Subjects absent from any tests were requested but not required to take them later.

One to three weeks after taking the library pretest the subjects were scheduled to use the teaching machine. Schedule sheets were passed out in class and the subjects were asked to sign up for one or two hour blocks (depending on the experiment running that term). Subjects were told that this was a regular course assignment and that they would be examined on the material presented by the programed instruction. Immediately following the programed instruction, the posttest was administered by a student research assistant in the Learning Center. Subjects who also received the Performance Rating Scale assignments did these assignments immediately after they had finished the posttest. All subjects were requested not to discuss the test questions (either written or performance) with their classmates. It was explained that such a discussion might adversely affect their own test grade if their classmates had prior knowledge of the test questions before taking the programed instruction.

In the experiments which incorporated a retention test, this test was given during the last week of classes for the term.

Originally three of the four library programs contained performance frames and one did not. A sample of subjects was assigned to go through three programs of which one did not contain performance, and complete assignments on the floor of the library. Each student was graded on a Performance Rating Scale by an observer on his terminal behavior in carrying out these assignments. The subjects did significantly better on assignments relating to the two programs which contained the performance frames than they did on the assignment relating to the program without these frames. It was suspected this result might be due to the different content in the programs.

VALIDATION OF PERFORMANCE FRAMES

The study was repeated in the present series with the presence or absence of perfo[illegible] variable. Performance frames were inserted in the one program originally without them. Three programs were used: 1 (the Card Catalog), 2 ([illegible]), and 3, (Readers' Guide and periodicals).

The Experimental group (N = [illegible]) completed the programs with all performance frames omitted. A control group of subjects (N = 42) used the same three programs with the performance frames included. All subjects were given the paper-and-pencil criterion test and then graded with the Performance Rating Scale while carrying out assignments in the library.

Results.

TABLE 1

Group Means on Criterion Test and Rating Scale

	Gain Scores on Criterion Test	Rating Scale*
No Performance Frames (Experimental)	14.72	72.95
Performance Frames (Control)	12.35	78.83

* p < .05

Originally three of the four library programs contained performance frames and one did not. A sample of subjects was required to go through three programs of which one did not contain performance, and complete assignments on the floor of the library. Each student was graded on a Performance Rating Scale by an observer on his terminal behavior in carrying out these assignments. The subjects did significantly better in assignments relating to the two programs which contained the performance frames than they did on the assignment relating to the program without these frames. It was suspected this result might be due to the different content in the programs.

The study was repeated in the present series with the presence or absence of performance frames as the experimental variable. Performance frames were inserted in the one program originally without them. Three programs were used: 1 (the Card Catalog), 2 (shelving), and 3, (Readers' Guide and periodicals).

The Experimental group (N = 22) received the programs with all performance frames omitted. A Control group of subjects (N = 42) used the same three programs with the performance frames included. All subjects were given the paper-and-pencil criterion test and then graded with the Performance Rating Scale while carrying out assignments in the library.

Results.

TABLE 1

Group Means on Criterion Test and Rating Scale

	Gain Scores on Criterion Test	Rating Scale*
No Performance Frames (Experimental)	14.22	72.95
Performance Frames (Control)	12.33	78.83

* $p < .05$

The Control group students using the performance frames accomplished the library assignments significantly better than the Experimental group at the .05 level of confidence (t=2.35). However, no significant difference was obtained between groups on the gain scores on the verbal criterion test.

Conclusions

Both the use of pictorial instruction frames[3] and the use of performance frames were validated in formal experiments. In both cases techniques simulating the real life situation made no difference in scores on the purely verbal criterion test but did make a significant difference in favor of simulation when assessed by the Performance Rating Scale measuring terminal behavior in the real life situation.

The simulation techniques also made it possible to reduce the terminological load of the programs since the sole purpose of the program was to get college students to use the university library quickly and efficiently --not to be able merely to talk or write about it.

Discussion

Of the principles derived from operant conditioning on which linear programing was founded, many have been shown by subsequent research to be questionable. Of the remaining principles, however, the most outstanding is the insistence in programing on specifying the terminal behavior expected of the learner after he has gone through the program. In practically all programed instruction, the terminal behavior required is interpreted as completing a paper-and-pencil test. (In the standards to be published by the Joint Committee on Standards in Programed Instruction it was only mentioned that terminal behavior might actually be performance of a skill.)

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[3] Ibid.

It is not surprising, therefore, to find in the present study that the inclusion of performance frames in the programs had no relation to the criterion scores on the paper-and-pencil test, but were correlated significantly with performance of actual tasks on the floor of the library as graded by the Performance Rating Scale.

It is so customary to measure learning by paper-and-pencil tests that in the learning of a skill such as using the university library the fact is often overlooked that it is quite possible to measure the actual performance of the skill rather than a paper-and-pencil surrogate. There are many similar subjects which can be taught by programed instruction where the terminal behavior can be identified as the actual performance of a skill and in that case a performance rating scale should be devised as the ultimate test of the learning.

The acquisition of a random-access tape recorder and player made possible the translation of the branching picture-print version of one of the library orientation programs to a purely audio version. The unit selected was one on the card catalog, Program 1. In the Experimental version (Audio-only), all of the instructional content of the pictures and of the print was translated into an audio message played on the random-access tape player. Only the diagnostic multiple choice question slides were retained in the print form because it was anticipated that audio multiple choice questions would be too confusing to the subjects. The random access tape player made it possible to branch the subject into wrong answer circuits exactly as in the original picture-print version.

AUDIO ONLY EXPERIMENT

Three samples of 22 subjects each were selected to form the control, experimental and [illegible] Picture-Audio version[4] in which the pictures were retained but the print was recorded into an audio message. The Experimental group received audio-only instructions. A third group (Zero) did not receive any instruction on the library. All subjects were selected from the same population of members of the Instructional Materials Course IM 417. These subjects were matched in triads on the verbal part of the SCAT score (within a 5 point range) and on pretest score (within a 3 point range). All subjects were also given Cattell's 16 Personality Factor Test and The Brown-Carlsen Listening Comprehension Test.

Results

The Audio-only Group and the Picture-Audio Group did not differ significantly as measured by two-tailed t-tests in gain scores between the

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[4] Wendt, McCoy, and Root, op. cit., pp. 27-32.

The acquisition of a random-access tape recorder and player made possible the translation of the branching picture-print version of one of the library orientation programs to a purely audio version. The unit selected was one on the card catalog, Program 1. In the Experimental version (Audio-only), all of the instructional content of the pictures and of the print was translated into an audio message played on the random-access tape player. Only the diagnostic multiple choice question slides were retained in the print form because it was anticipated that audio multiple choice questions would be too confusing to the subjects. The random access tape player made it possible to branch the subject into wrong answer circuits exactly as in the original picture-print version.

Three samples of 33 subjects each were selected to form the control, experimental and zero groups. The Control group saw Picture-Audio version[4] in which the pictures were retained but the print was recorded into an audio message. The Experimental group received audio-only instructions. A third group (Zero) did not receive any instruction on the library. All subjects were selected from the same population of members of the Instructional Materials Course IM 417. These subjects were matched in trios on the verbal part of the SCAT score (within a 5 point range) and on pretest score (within a 3 point range). All subjects were also given Cattell's 16 Personality Factor Test and The Brown-Carlsen Listening Comprehension Test.

Results

The Audio-only Group and the Picture-Audio Group did not differ significantly as measured by correlated t-tests in gain scores between the pretest and the posttest, nor between the pretest and a retention test given at the end of the term. Also, these two groups did not differ significantly in the average amount of time spent on the program. These facts are represented in Table 2.

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[4] Wendt, McCoy, and Rust, op. cit., pp. 27-32.

TABLE 2

Group Means on the Criterion Test

	Pretest	Posttest gain	Retention gain	Program time in min.
Audio-only (Experimental)	10.17	6.14	5.57	28.79
Picture-Print (Control)	10.62	5.10	4.63	27.80
Zero	10.30	None	0.75	None

There was no significant correlation between the Brown-Carlsen Listening Comprehension Test scores of the subjects and their gain scores.

The pretest scores were negatively correlated with the gain scores at the .02 level of confidence for the Audio-only group ($r=-.646$, $N=33$), and at the .01 level of confidence for the Picture-Audio group ($r=-.369$, $N=33$). This is consonant with the well known ceiling effect.

Program time correlated significantly in a negative direction with SCAT scores in the Audio-only group ($r= -.502$, $p < .01$, $N=30$) but not in the Picture-Audio group ($r= +.039$, $N=30$). The Audio-only group also showed a significant negative correlation between program time and the Brown-Carlsen Listening Comprehension Test ($r= -.410$, $p < .05$, $N=28$). Once again the Picture-Audio group correlation was not significant ($r= -.145$, $N=30$). The correlation between SCAT and the Brown-Carlsen Listening Comprehension Test in the Audio-only group was $r= +.445$. Partial correlation techniques indicated that listening scores and program time were not significantly negatively correlated when SCAT scores effects were partialed out. However, the negative correlation between SCAT and program time was significant at the .05 level of confidence when listening scores were partialed out. (r SCAT, program time • listening = -.393).

Three of the 16 Personality Factors correlated significantly with program time in the Audio-only group but not the Picture-Audio group. These factors are listed in Table 3.

TABLE 3

Correlation of Personality Factors with Program Time

Audio-only Group

Factor	Low Score Description	High Score Description	r	p
A	Sizothymia (reserved)	Cyclothymia (warm-hearted)	-.507	< .02
B	Lower scholastic mental capacity	Higher scholastic mental capacity	-.561	< .02
C	Lower ego strength (affected by feelings)	Higher ego strength (emotionally stable)	+.384	< .05

Correlations between the 16 Personality Factors and the two types of gain scores (post and retention) were not significant (this program contained no by-passes).

Conclusions

The Audio-only group achieved as well as the Picture-Audio group. There was no difference in time spent on the program.

Bright subjects took less time on the program in the Audio-only group. This variable was not significantly correlated with program time in the Picture-Audio group.

Both the Audio-only and Picture-Audio groups did significantly better than the Zero group which received no instruction. This confirms the results obtained in several previous experiments comparing the groups which received experimental versions of the programed instruction with zero groups. The Audio-only and Picture-Audio groups always did significantly better than the Zero group as measured in gain scores.

Discussion

Although the pictures apparently did not result in significant improvement compared to a purely audio program, it must be remembered that the results were measured by the purely verbal criterion test. In previous experiments it was shown that the pictorial frames and the performance frames did not improve instruction when measured by the verbal criterion test. However, when the learning was measured by the Performance Rating Scale, evaluating subjects' actual performance of assignments in the library, both pictorial and performance frames resulted in significant improvements in learning.

Possibly the present experiment would also have shown a significant difference in favor of the Picture-Audio group if the Performance Rating Scale had been used to measure terminal behavior. Unfortunately, this was not possible because the use of the Performance Rating Scale is very time-consuming (30 minutes-60 minutes per subject) and was too expensive for this project.

It is not surprising that there was no difference between the Experimental and Control groups in time to complete the program since audio tended to pace the subject. Subjects did not view this pacing as unduly rapid. Although the control board was equipped with a button which would summon the random-access tape player to repeat a message subjects never availed themselves of this opportunity.

QUESTION DELAY EXPERIMENT

In a previous study[5] it was reported that when the subjects were categorized into three groups according to reading ability (high, medium, and low), the medium and low groups significantly exceeded the high reading group on the criterion test after going through four standard programs (Picture-print) on the use of the library. Possibly the good readers did not pause thoroughly to consider the answers to diagnostic questions in the program.

It was hypothesized that good readers could profit from spending more time with diagnostic questions in the program. An experiment was therefore set up which introduced a 15 second-delay on every question frame in Program 2. Each subject was unable to move to the wrong or right answer frame (whichever it might be) until a signal light operated by the delay device went out. Two groups of subjects of thirty each were matched by the pretest (within 3 points) and by the School and College Ability Test (verbal section, within 5 points). The Experimental group encountered the delay device; the Control group did not. All subjects were also given the 16 Personality Factor Test.

To determine what would be the appropriate delay interval, a tabulation had been made of the actual time spent on each question frame by subjects in previous experiments using the standard Picture-print program. The median interval lay near 10 seconds. The delay interval was set at 15 seconds so that most of the subjects would be delayed.

Results.

A t-test comparison on the pre-posttest gain showed no significant difference between the Delay and Non-delay groups.

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[5] Ibid., pp. 13-14.

A retention test given at the end of the term resulted in a significant difference in gain scores (from the pretest and the retention test) at the .05 level of confidence in favor of the Delay group. These means are given in Table 4.

TABLE 4

Group Means on Criterion Test

	Pretest	Posttest gain	Retention gain	Program time in minutes
Delay (Experimental)	16.83	4.00	3.62	20.83
Non-Delay (Control)	16.75	3.31	1.89	19.52

There was no significant difference between Delay and Non-delay groups on program time, number of by-passes attempted, or number of by-passes successfully completed.

Three of the 16 Personality Factors were significantly correlated with number of by-passes attempted by subjects in the Delay group. The factor descriptions and their correlations are presented in Table 5, (N=23). No significant correlations were obtained in the Non-delay group.

TABLE 5

Correlations of Personality Factor Scores with Number of By-passes Attempted

Factor	Low Score Description	High Score Description	r	p
M	Praxermia (Practical)	Autia (Imaginative)	+.632	$< .01$
Q_3	Low Integration (Controlled)	High self-concept control (Casual)	-.545	$< .02$
Q_4	Low ergic tension (Relaxed)	High ergic tension (Tense)	+.445	$< .05$

The by-pass data for all subjects having the factor constellation of High M-Low Q_3-High Q_4[6] was inspected. Each of the 6 Delay subjects with this constellation attempted all of the by-passes. Nearly identical results were exhibited by the 7 subjects with the same constellation in the Non-delay group--6 of the 7 tried all by-passes (the 7th tried 2 out of 3 by-passes). However, in both groups, subjects with the opposite factor constellation of Low M-High Q_3-Low Q_4 were not consistent in their choice to try or omit the by-passes.

The only significant correlation obtained between 16 Personality Factor scores and program time was with Factor C ($r=+.391$, $N=27$, $p=.05$). Factor C (ego strength) was one of the 3 factors which had yielded a significant correlation with program time in the experimental group in the Audio-only experiment. Again, the correlation was significant only in the Experimental (Delay) group.

Conclusion.

Delay on question slides did not significantly improve the subjects' gain scores on a criterion test. However, question delay did aid retention gain scores of the Delay group as compared with the retention gain scores of a Non-delay group.

Most subjects who had the 16 Personality Factor Constellation, High M-Low Q_3-High Q_4 attempted all the by-passes.

Discussion.

Was the 15 second delay near the optimum? Delay undoubtedly had a differential effect on subjects. Some were delayed by a 15 second interval and some were not. Some subjects might have profited from a longer delay and others from a shorter delay. To answer this question a series of experiments would be needed using different delay intervals such as 10, 15, 20, 25, 30 seconds. An analysis of such a new series of graduated intervals should be made to relate benefits of delay to subjects' characteristics such as SCAT, reading speed, and pretest scores and personality factors.

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[6] The requirements for the High M-Low Q_3-High Q_4 constellation were set as High M and Q_4 = stens 5, 6, 7, 8, 9, or 10. Low Q_3 = stens 0, 1, 2, 3, 4, or 5 with the additional restruction that the subjects sten of M or Q_4 (whichever is lowest) minus his Q_3 sten ≥ 2.

OPTIONAL RESUMES FROM THE BY-PASS

In the report on the previous series of studies, it was noted that "some students in the experiment wished there were voluntary exits from by-passes. That is, during the sequence of four by-pass questions, some subjects for some reason changed their minds and wanted to get back on the main line and not skip part of the instruction."[7] This request was also made by a number of subjects in subsequent experiments.

The purpose of the present experiment was twofold: (a) to determine what percentage of subjects would choose the option to return to the main line when given the choice of return or skipping ahead, and (b) to explore the relationship of measures such as pretest score and personality with subject behavior at the critical decision points.

OPTIONAL RETURNS FROM THE BY-PASS

Since the interest was in the subject's behavior at the completion of each by-pass, subjects were not given the option of dropping out of any training by-pass questions in this experiment; they were forced into every by-pass. Previous experiments had indicated that not all subjects will choose to take the by-passes. The forced entry slide was the following format, bringing the subject into a by-pass sequence:

> "Perhaps you already know some facts concerning ideas in this theory.
>
> If you can pass several questions about this subject, you will be allowed to skip part of the instruction.
>
> Go on now."

Subjects who failed any part of the by-pass sequence of questions which, if passed, would have qualified them to skip some instruction were, as usual, returned directly to the main line. Subjects who successfully completed

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[7] Wendt, McCoy, and Rust, op. cit., p. 13.

In the report on the previous series of studies, it was noted that "some students in the experiment wished there were voluntary exits from by-passes. That is, during the sequence of four by-pass questions, some subjects for some reason changed their minds and wanted to get back on the main line and not skip part of the instruction."[7] This request was also made by a number of subjects in subsequent experiments.

The purpose of the present experiment was twofold: 1) to discover what percentage of subjects would choose the option to return to the main line when given the choices of return or skipping ahead, and 2) to explore the relationship of measures such as pretest score and personality with subject behavior at the critical decision points.

Since the interest was in the subject's behavior at the completion of each by-pass, subjects were not given the option of trying, or not trying, by-pass questions in this experiment; they were forced into every by-pass. Previous experiments had indicated that not all subjects will choose to try the by-passes. The forced entry slide had the following format (sending the subject into a by-pass sequence):

> "Perhaps you already know about catalog cards in the library.
>
> If you can pass several questions about this subject, you will be allowed to skip part of the instruction.
>
> Go to 334"

Subjects who failed any part of the by-pass sequence of questions which, if passed, would have qualified them to skip some instruction were, as usual, returned directly to the main line. Subjects who successfully completed all the questions in a by-pass sequence were presented with an optional return slide which read like this sample:

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[7] Wendt, McCoy, and Rust, op. cit., p. 13.

> "You have earned the right to
> skip part of the instruction.
> If you want to do so, go to 131.
>
> However, if you feel that you
> might be missing something
> and don't want to skip part of
> the instruction, go to 149."

Any subject who rejected the opportunity to skip ahead was returned to the same frame in the main line as subjects who failed the by-pass questions.

Forty-one female subjects from IM 417 classes took part in this experiment.[8] These subjects were given three programs on the use of the library: Program 1, 3a, 3b. There were a total of nine by-passes. In Program 1, the first, second, and fourth by-passes consisted of three questions each; the third by-pass contained only two questions. Program 3a contained two by-passes of three questions each, and Program 3b contained three by-passes of three questions each. (Multiple questions reduce the chance of success by guessing.)

Results.

Subjects were classified as to whether they passed or failed each of the nine by-passes. The difficulty level of each by-pass can be inferred from the data in Table 6. Some by-passes appear extremely hard and others appear too easy. However, inspection of the main line program content in relation to by-pass questions revealed that the content and question difficulty level were appropriate to the subject matter being queried.

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[8] Women subjects only were used in this study for reasons of expediency. The study of Risk-taking had to be limited to male subjects, leaving an available supply of female subjects. All previous research in this series had shown no significant difference by sex in the variables of programed instruction under study.

TABLE 6

Difficulty Level of the By-passes

By-Pass Number	Program 1 1	 2	 3	 4	Program 3a 5	 6	Program 3b 7	 8	 9
Number of Students Passed	30	5	34	33	18	12	4	29	8
Number of Students Failed	11	36	7	8	23	29	37	12	33

Eighteen of the forty-one subjects chose to return to the main line one or more times. Five of these eighteen chose to return every time they could. Two of the eighteen chose to return more times than they chose to by-pass ahead; three of the eighteen chose to return and by-pass an equal number of times; and eight of the eighteen subjects chose to return fewer times than they skipped ahead.

A correlation was run between the number of times a subject chose the optional return and his total number of by-pass completions. This correlation was not significant ($r=+0.13$) indicating no functional relation between subject ability to complete the by-passes and the number of times subjects chose to return to the main line.

To determine whether or not students "return or by-pass" choice was related to pretest scores, a ratio, $\frac{\text{actual returns}}{\text{possible returns}}$ was obtained for each subject. In other words, the number of times a subject chose to return to the main line was divided by the number of times he had earned the right to by-pass. The obtained ratios were classified as:

Ratio		Description
0	=	The subject never chose to return to the main line, he always skipped ahead
< 1/2	=	the subject chose to return to the main line fewer times than he chose to skip ahead
1/2	=	the subject chose to return to the main line as often as he chose to skip ahead
> 1/2	=	the subject chose to return to the main line more times than he chose to skip ahead
1	=	the subject always chose to return to the main line, he never skipped ahead.

Table 7 gives the mean pretest scores and the number of subjects classified under each of these ratios. A simple randomized analysis of variance was run on this data but the F was not significant. This result indicated there was no meaningful relationship between the ratio of $\frac{\text{actual returns}}{\text{possible returns}}$ and pretest score.

TABLE 7

Mean Pretest Scores for Subjects Classified by Ratio of $\frac{\text{Actual returns}}{\text{Possible returns}}$

Ratio	0	< 1/2	1/2	> 1/2	1
N	23	8	3	2	5
Pretest mean	27.09	28.62	30.00	28.50	23.40

In order to determine the relationship between successful by-pass completion and pretest score, the number of by-passes successfully completed within each program was obtained for each subject.

A similar by-pass classification was obtained for subjects within each program. Subjects were classified in Program 1 as to whether they had successfully completed 0, 1, 2, 3, or 4 by-passes. For Program 3a, they were classified as to whether they had completed 0, 1, or 2 by-passes. For Program 3b, they were classified as to whether they had completed 0, 1, 2, or 3 by-passes.

An over-all programs classification was obtained. This was accomplished by summing for all three programs the number of by-passes successfully completed by each subject. The subject was then placed into one of four classifications based on this summation.

Poor by-pass success	=	0, 1, or 2 by-pass completions
Moderate by-pass success	=	3 or 4 by-pass completions
Good by-pass success	=	5 or 6 by-pass completions
High by-pass success	=	7, 8, or 9 by-pass completions

The appropriate means scores for subjects in each of the above classifications was then obtained. (See Talbe 8). Because gain scores were not a variable in this experiment, the posttest was not used.

TABLE 8

Group Pretest Means by Number of By-Passes Completed

All Three Programs	Number of By-Passes Successfully Completed[a] 0, 1, 2	3, 4	5, 6	7, 8, 9
N	6	17	16	2
Mean	23.67	25.35	29.44	36.00
Program 1[b]	1	2	3	4
N	5	12	21	3
Mean	14.00	14.08	16.52	19.67
Program 3a	0	1	2	
N	17	19	5	
Mean	3.24	4.21	4.80	
Program 3b	0	1	2	3
N	11	22	7	1
Mean	7.36	7.64	8.28	12.00

[a] No subject failed all of the by-pass questions.

[b] No subject recorded for "0" category.

The means in Table 8 indicate there is no strong positive relationship between number of by-passes successfully completed and subjects' average pretest scores, although the trend is in this direction. A simple randomized analysis of variance was computed on the "Total of Three Programs" data. The obtained F value was not significant; however, the small N's found in the first and last cells make tenuous any conclusion as to the relation between successful by-pass completion and pretest score.

Each subject filled out the Rotter Incomplete Sentences Blank (RISB), a personality test discussed later in the Risk experiment. This test was administered in class by a clinical psychologist who had had previous experience with the RISB and who was not known to the students (to minimize subjects associating the personality measure with the experimental library program). The RISB's were scored for adjustment using the procedures described in Rotter's Manual.[9]

A correlation was obtained between subjects adjustment score and the number of by-passes successfully completed. This correlation was not significant ($r= -0.05$, $N=41$).

The next question investigated was: Is there any relationship between subjects personality, as measured by Rotter's adjustment scores and his "return or by-pass" choice, as measured by the $\frac{\text{actual returns}}{\text{possible returns}}$ ratio? The range of adjustment scores were divided into two categories: well-adjusted and maladjusted. The cutting line, 135, suggested by Rotter[10] to differentiate between adjusted and maladjusted individuals was used for the upper limit of the well-adjusted chategory.

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[9] Julian B. Rotter and Janet E. Rafferty, *Manual, The Rotter Incomplete Sentences Blank-College Form* (New York: The Psychological Corporation, 1950).

[10] *Ibid*., p. 10.

Table 9 presents the average ratio of $\frac{\text{actual returns}}{\text{possible returns}}$ for subjects within each of the adjustment categories. It can be seen that the maladjusted subjects have a slightly higher mean ratio of $\frac{\text{actual returns}}{\text{possible returns}}$ than the well-adjusted subjects. A simple t-test computed between the mean ratio was not significant.

TABLE 9

Mean Ratio: $\frac{\text{Actual returns}}{\text{Possible returns}}$ for Adjustment Categories

	Well-Adjusted	Maladjusted
Adjustment Score Range	105-135	136-203
Number of subjects	14	27
Mean of $\frac{\text{Actual returns}}{\text{Possible returns}}$	0.10	0.29

Conclusions.

No significant relationships were established between the subjects' ratio of $\frac{\text{actual returns}}{\text{possible returns}}$ to the main line and the a) number of by-passes subjects successfully earned and b) subjects' pretest score.

No significant difference was found between well-adjusted and maladjusted categories on the Rotter Incomplete Sentences and subjects ratio: $\frac{\text{actual returns}}{\text{possible returns}}$.

There was no evidence of any relationship between pretest scores and successful earning of by-passes.

There is a need for optional returns from by-passes since this investigation clearly showed that a substantial percentage of the subjects (18 out of 41 or 44%) refused the earned by-pass at least once and 5 out of 41 or 12% refused every earned by-pass. This study did not, however, reveal the pre-conditions or traits related to this phenomenon.

Discussion.

The decision of some students to return to the main line of programed instruction even though they had earned the right to skip part of the program reflects an interesting aspect of personality. Obvious lines of further research would test the relationship of this behavior to IQ, to academic ability as measured by ACT or by grade point average, or to factors of need for academic achievement and expectancy of achievement as measured by the Rotter Incomplete Sentences Blank when scored for these factors.

[illegible] by answering correctly three or four difficult questions give the subject an opportunity to skip, or by-pass, part of the programed instruction. [illegible] by-pass is one which gives the subject the opportunity of seeing the exact wording of the first multiple choice [illegible] the alternative answered. A blind by-pass informs the subject of the general content area about which he will be [illegible] but does not give a specific question.

Visible By-pass Format [illegible]

[illegible]

Blind By-pass Format

Perhaps you already know a [illegible] about [illegible] in the [illegible].

If you can pass several hard questions about this subject, you will be allowed to skip this part of the instruction.

If you don't want to try it [illegible]
Go to [illegible]

If you want to try it,
Go to [illegible]

VISIBLE AND BLIND BY-PASSES

[illegible] how to use the [illegible] subjects [illegible] 11 However, [illegible] in Programs 2 and 3 [illegible] Program 1 did not originally [illegible] had necessarily [illegible] the difference in the proportion of [illegible]

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11 [illegible], op. cit., pp. 12-13.

By-passes earned by answering correctly three or four difficult questions give the subject an opportunity to skip, or by-pass, part of the programed instruction. A visible by-pass is one which gives the subject the opportunity of seeing the exact wording of the first multiple choice question in by-pass sequence (but not the alternative answers). A blind by-pass informs the subjects of the general content area about which he will be interrogated but does not give a specific question.

Visible by-pass format:

Perhaps you already know a lot about catalog cards in the library.

Read this hard question,
"How many books in the library have a card?"

If you can pass several hard questions like this, you will be allowed to skip part of the instruction.

If you don't want to try it,
Go to 149

If you want to try it,
Go to 334

Blind by-pass format:

Perhaps you already know a lot about catalog cards in the library.

If you can pass several hard questions about this subject, you will be allowed to skip this part of the instruction.

If you don't want to try it,
Go to 149

If you want to try it,
Go to 334

Previous experimentation utilizing programs on how to use the university library revealed the unexpected result that subjects shied away from visible by-passes and tended to try a blind by-pass.[11] However, comparable blind and visible slides were located in Programs 2 and 3 and one blind entry slide in Program 4. Program 1 did not originally contain by-passes. Since the instructional content had necessarily differed among the three programs, the difference in the proportion of subjects choosing to try and choosing to omit the blind and visible by-passes might have been a function of program content rather than difference in type of by-pass entry.

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[11] Wendt, McCoy, and Rust, op. cit., pp. 12-13.

In the present experiment all subjects were given three programs on the use of the library, Programs 1, 3a, and 3b (the card catalog, periodicals, Readers' Guide). The three library programs contained a total of nine by-pass entries. Four in Program 1, two in Program 3a, and three in Program 3b.

The experimental samples were taken from IM 417 classes. One group of 37 subjects received the programs with blind entry frames substituted for the visible entry frames. Subjects were alternately assigned to the Blind and Visible conditions with the restriction that the ratio of males and females be equal between the two conditions. Seven subjects were dropped from the analyses because of missing data or because they were foreign students. This left an N=37 in the Visible group and N=30 in the Blind group.

A pretest to assess the subjects' knowledge about library procedures was administered in class by the IM 417 instructor prior to the subjects signing up for library instruction. The subjects were told as usual that participating in the programed instruction was a course requirement.

A posttest immediately followed each subject's programed instruction. Previous research by Rust[12] had indicated that gain scores of subjects who receive the posttest immediately following instruction did not differ substantially from gain scores of subjects who receive the posttest in a few days after program completion. Toward the end of the term the class instructor administered the reading section of the "Cooperative English Test C2: Reading Comprehension" and an abridged version of the 16 Personality Factor Test. The subjects were told that these tests were part of a survey.

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[12] Rust, op. cit., unpublished doctoral dissertation.

Due to classroom time pressure, it was not feasible to have the subjects fill out the complete 16 Personality Factor Test. The test was shortened to those 8 factors which seemed most indicative of further exploration as based on previous analyses. The 8 factors were the ones which most frequently entered into the prediction of by-pass behavior, program time, and gain score. These predictions were based on first order correlation matrices and Wherry-Doolittle analyses resulting from data obtained in the Audio-only and Question Frame Delay experiments, and from the 16 Personality Factor Test administered to subjects in a concurrent experiment conducted by Rust. The 8 factors are described below.

	Low score description	High score description
Factor C	Lower ego strength (affected by feeling)	Higher ego strength (emotionally stable)
Factor F	Desurgency (sober)	Surgency (happy-go-lucky)
Factor G	Weaker super-ego strength (expedient)	Stronger super-ego strength (conscientious)
Factor I	Harria (tough-minded)	Permsia (tender-minded)
Factor L	Alaxia (crusting)	Protension (suspicious)
Factor M	Praxernia (practical)	Autia (imaginative)
Factor Q_3	Low integration (casual)	Self-concept control (controlled)
Factor Q_4	Low ergic tension (relaxed)	High ergic tension (tense)

Results

The Blind and Visible groups did not significantly differ in their Reading Comprehension Speed and Level scores. No further analyses were made using these variables.

The pretest scores are presented in Table 10. The Blind (N=30) and Visible (N=37) differed significantly on all programs except the first. This necessitated the use of analyses of covariance on the gain scores with pretest scores held constant. The obtained F values were not significant. Thus, the null hypothesis was upheld that there would be no difference in gain scores between the Blind and the Visible groups.

TABLE 10

Group Means on Criterion Test Scores

	Blind		Visible	
Program	Pretest	Gain	Pretest	Gain
1	17.23	5.40	16.08	6.40
3a	4.90	1.93	3.92	2.43
3b	8.10	1.83	6.84	3.03
Total	30.23	9.17	26.84	11.86

The major aim of investigation in the present experiment was to determine whether or not subjects in the Blind and Visible conditions would differ in the number of times they would attempt to try the by-passes. It was found that there was an average of 5.87 tries per subject in the Blind group. In the Visible group there was an average of 4.89 tries per subject. The t-test on this difference was not significant.

A four-way analysis was made dichotomizing the Visible and Blind groups by sex. (See Table 11.) A t-test of gain scores between males and females in the Visible group was not significantly different. Since the sex difference in the Blind group was smaller than in the Visible group, no analysis was made.

TABLE 11

Mean Number of By-Passes Attempted

	Females		Males	
	mean	N	mean	N
Visible	4.10	21	4.94	16
Blind	4.72	25	4.46	13

The eight personality factors chosen (from Catell's 16 Personality Factor Test) for the present experiment were investigated with respect to the subject's decision to try or omit the by-passes. In order to increase the number of subjects, the abridged 16 Personality Factor Test was also administered to the subjects reported next in the Review experiment; these subjects received the Blind program in addition to the review circuits. The report of this study immediately follows the Blind-Visible report.

Since the program instruction and diagnostic frames were identical in the Blind, Visible, and Review groups, it seemed permissable to combine them for this analysis. Further support for combining the three groups was the similarity of the distribution of the subjects' behavior in by-pass choice. This similarity is indicated by the non-significant

D's obtained by the Kolmogorov-Smirnov two-sample test ($\alpha = .10$). On the distributions presented in Table 12, tests were run between a) the Blind and Visible groups and b) the Blind and Review groups.

TABLE 12

Distribution of Subjects By Number of By-Passes Attempted

Number of By-passes Tried	0	1	2	3	4	5	6	7	8	9
Visible	10	1	3	2	2	0	5	10	3	4
Blind	8	2	6	0	2	1	2	5	6	6
Review	10	2	3	1	4	5	1	9	7	19

It was reported in the Delay experiment that analyses of the 16 personality factors with by-pass behavior (subjects decision to try or omit by-passes) resulted in the discovery that all but one of the subjects, in both the Experimental and Control groups, having the factor constellation of High M, Low Q_3, High Q_4, tried every by-pass. Because of this result it was predicted that in the present series of experiments, most subjects having the High M-Low Q_3-High Q_4 factor constellation would try every by-pass. However, when the data from the 18 qualified subjects in the Blind, Visible, and Review groups were analyzed the prediction was not upheld. Six of these subjects tried fewer than three by-passes, two tried four by-passes, and 1 tried six by-passes. Only 9 subjects tried seven or more of the nine by-passes.

A final set of analyses was made relating each of the 8 personality factors with total number of by-passes attempted by each subject (N=118). No significant results were obtained.

Conclusions

The analyses showed that there was no significant difference in gain scores between the Blind and Visible groups whether on the scores of all three programs combined or on any single one of the three programs.

Neither was there any significant difference between the two groups in the frequency distribution of subjects' choice to try or choice to omit the by-passes.

Although a previous experiment indicated that 3 factors of the 16 Personality Factor Test might be useful in predicting whether or not subjects used by-passes, the present experiment did not uphold this hypothesis.

Discussion

It is clear that the difference in format between Visible and Blind entry frames to by-passes was not a factor in determining whether the subjects elect to pick the by-passes or not. Previous experimentation by Wendt and Rust showed no significant relation between by-pass choice and the subjects' SCAT scores, his pretest scores, or his being positively or negatively reinforced by prior success or failure on by-pass questions. This decision apparently depended on some other factors, possibly personality factors. Apparently it is immaterial whether a programer uses blind or visible by-pass entry frames. Since the blind entry frames are always shorter, presumably it would be more efficient.

In a previously reported experiment[11] it was found that review circuits at the beginning of programs were ineffective and produced negative reactions. Students eager to make progress at the beginning of a new program were confronted with a review of the previous program and were annoyed by the delay. In the present experiment two of the three programs (2a and 3a) were extended by adding six review questions and their associated review circuits to the end of the program.

Figure 1 shows how these circuits were layed out. It was designed so that if the subject missed any two or more of the six review questions, he was cycled back to begin the review series again.

At the end of each regular program, the subject encountered a bridging slide which informed him of the subsequent review. The subject was then presented with question 1X. If he was successful, he proceeded to question 2X. If he continued being successful, he would proceed through questions 3X, 4X, 5X, 6X and leave the program.

REVIEW CIRCUITS

If on the other hand, he failed question 1X, he proceeded to a wrong answer frame, then to an instruction frame which gave a brief review of the matter, and then question 1Xa (which is identical to question 1X with a new frame number and "go to's"). If he was successful this time, he proceeded to question 2Xa (the same as 2X) and then with continued success right through the rest of the six questions and out.

If on the other hand, he failed question 1Xa, he again proceeded to a wrong answer frame, to remedial instruction, and to question 1Xb (1X, 1Xa, and 1Xb are identical in content but they have different frame numbers and "go to's"). If he got 1Xb wrong he would cycle back to the

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[11] Wendt, McCoy, and Rust, *op. cit.*, p. 13.

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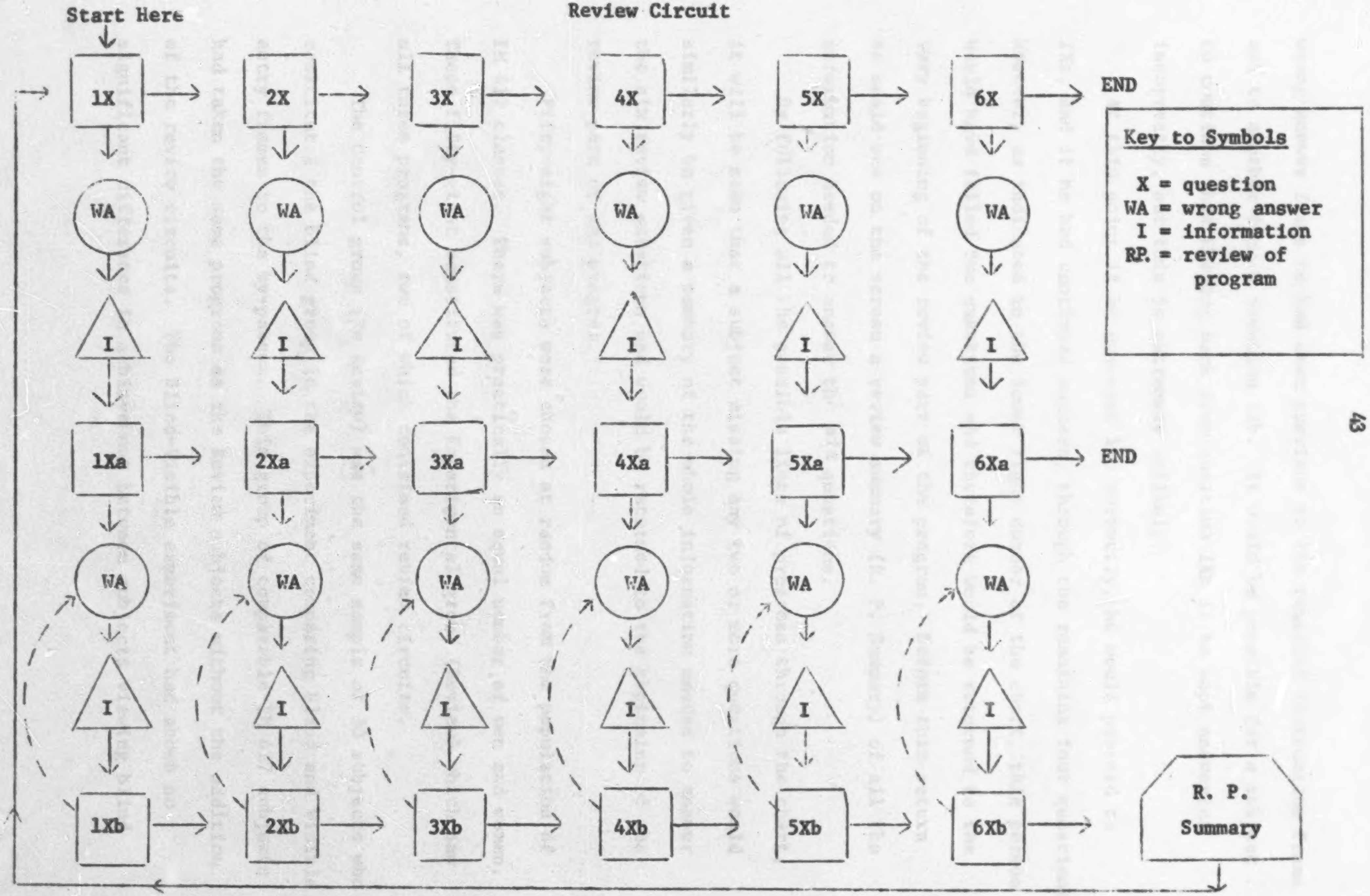
[13] Wendt, McCoy, and Rust, op. cit., p. 13.

FIGURE 1

Review Circuit


Start Here
1X
2X
3X
4X
5X
6X
END
WA
I
1Xa
2Xa
3Xa
4Xa
5Xa
6Xa
END
1Xb
2Xb
3Xb
4Xb
5Xb
6Xb
R. P.
Summary
Key to Symbols
X = question
WA = wrong answer
I = information
RP. = review of program

wrong answer frame he had seen previous to the remedial instruction frame and to another chance question 1Xb. It would be possible for a subject to continue this cycling back from question 1Xb if he kept answering incorrectly, but this is extremely unlikely.

At this point if he answered 1Xb correctly, he would proceed to 2Xb, and if he had continued success, through the remaining four questions. However, as indicated in the lower right corner of the chart, this person would have failed two questions and therefore would be returned to the very beginning of the review part of the program. Before this return he would see on the screen a review summary (R. P. Summary) of all the information needed to answer the six questions.

By following all the possible lines of progress through the chart, it will be seen that a subject missing any two or more questions would similarly be given a summary of the whole information needed to answer the six review questions and would be returned to the beginning of the review part of the program.

Fifty-eight subjects were chosen at random from the population of IM 417 classes. There was practically an equal number of men and women. These fifty-eight constituted the Experimental group (Review) which saw all three programs, two of which contained review circuits.

The Control group (No Review) was the same sample of 30 subjects who constituted the Blind group in the experiment comparing Blind and Visible entry frames to the by-passes. This group of comparable IM 417 subjects had taken the same programs as the Review subjects without the addition of the review circuits. The Blind-Visible experiment had shown no significant difference in achievement between subjects viewing blind and visible by-pass entry frames. Consequently the blind entry frames were adopted as standard for the Review experiment because they took less of the learner's time to read.

Both the Control and the Experimental samples were given the criterion test as a pretest and as a posttest. Gain score was the dependent variable. The independent variable was the difference between seeing review circuits or not seeing these circuits.

Previous experimentation has consistently shown a definite ceiling effect of high pretest scores on gain scores. In Programs 1 and 3a, there were no significant differences between the Experimental and Control groups on pretest scores. Therefore, the gain score differences between the two groups for Programs 1 and 3b could be analyzed by the use of the pooled variance t-test. However, because the Program 3a pretest score difference between the Experimental and Control groups approached significance ($p < .10$), analysis of covariance holding pretest scores contant was used on the 3a gain scores to counteract the ceiling effect.

Results

Since Program 1 was identical for both Experimental (Review) and Control (No Review) groups, it was assumed prior to commencement of the experiment that no significant difference between group means scores would be obtained if the effect of the program on the subjects in the two groups were equal. Table 13 indeed shows that no difference between the two groups in Program 1 gain scores was obtained; therefore, any differences between the gain scores of the Experimental and Control groups on Program 3a and 3b should be an effect of the experimental treatment variable rather than any other difference between the Review and No Review groups. In analysis of the mean gain scores for Program 3b, the p is significant ($p < .05$) in the hypothesized direction indicating that the Review circuit students gained significantly more than the Controls. However, the hypotheses is not upheld for the Program 3a mean gain score difference between groups. Here a non-significant gain difference was obtained.

TABLE 13

Comparison of Gain Scores

	Pretest Mean		Mean gain		Gain Comparison		
Program	Review	Control	Review	Control	t	F	p
1	16.19	17.23	5.98	5.40	0.92		
3a	4.25	4.90	2.20 *	2.61 *		1.50	<.20
3b	7.77	8.10	2.81	1.83	2.13		<.05
TOTAL	28.21	30.23	11.22 *	9.82 *		2.71	<.20

* means adjusted for pretest differences

An analysis of the average number of errors in Program 3a per subject per diagnostic question was compared for the Control and the Experimental groups. This ratio was .38 for the Control group and .37 for the Experimental group. A similar analysis for Program 3b showed an average error of .09 for the Control group and .02 for the Experimental group. Obviously these are not significant.

In total elapsed time, it was found that on the average subjects taking the two programs with the Review circuit required ten minutes more than the Control subjects taking the identical two programs without the circuits. Since the average program time was approximately twenty minutes, this was a 50 percent increase. The previous low level of significance of the difference between the mean gain scores of the two groups indicates the additional time required to go through the review circuit was probably not worthwhile.

The 52 subjects with complete sets of test scores in the Experimental group were arbitrarily categorized as high, moderate, or low on the basis of their pretest scores. A similar categorization was made with subjects in the Control group. At each pretest level, subjects gain scores were compared between the Experimental and Control groups. In Program 3a, the moderate and low level subjects showed no significant difference in gain scores between the two groups. The high level subjects showed a significant difference at the .10 level of confidence in favor of the Review circuit subjects. In Program 3b the high and moderate groups were not significantly different in gains. The low group was significantly different beyond the .10 level of confidence in favor of the Review Circuit subjects (See Table 14).

TABLE 14

Gain Score Comparison Between Groups Based on Pretest Level Classification

	Review		Control			
Program 3a pretest range	N	mean gain	N	mean gain	t	p
High 6-9	12	1.83	11	0.83	1.83	< .10
Mod. 4-5	23	2.43	15	2.40	.06	-
Low 1-3	17	3.82	4	3.25	.75	-
Program 3b						
High 10-12	13	1.08	8	0.75	0.51	-
Mod. 7-9	23	2.48	18	2.06	0.74	-
Low 3-6	16	4.69	4	3.00	1.72	< .10

Analyses of Review Circuit Group Only:

The Review subjects were grouped into six categories as follows:

		Number of subjects	
	Program	3a	3b
Q_1 = gets all review questions right first time		23	17
Q_2 = gets one question wrong (i.e. exits unit from second line)		24	22
Q_3 = gets into RP (Review of Program) line, but exits in Q_1 next time around		7	11
Q_4 = gets into RP line, but exits in Q_2 next time around		3	5
Q_5 = gets into RP line and exits in Q_1 third time around		0	0
Q_6 = anything worse than Q_5		0	2

Subjects "Q" number (1, 2, 3, 4, 5, or 6) in Program 3a was correlated with the total number of errors made in the by-passes. This correlation was not significant ($r=0.10$). A similar correlation of Q number with errors made in the main line diagnostic questions also resulted in a non-significant correlation, $r=0.19$.

Similarly, subjects Q number in Program 3b was correlated with the errors made in the by-passes; the $r=.01$ was not significant. The "Q" correlation with errors in the main line diagnostic questions resulted in $r=0.57$ which was significant beyond the .01 level of confidence.

The correlation between subjects Q number in Program 3a and time to complete the review circuit in Program 3a is $r=+.72$. A similar correlation in Program 3b is $r=+.68$. Both correlations are significant beyond the .01 level of confidence.

It was hoped that analyses could be made to determine the relationship between subjects "Q" number on one hand and on the other hand, the subjects pretest, posttest, and gain scores. This was not possible because most of the subjects were in categories Q_1 or Q_2, leaving too few data in the remaining categories for any statistical analysis.

Another inquiry was designed to find out if the addition of a review circuit at the end of a program would increase the number of times a subject would choose to try, rather than omit, the by-passes in the next program. Two ratios of $\frac{\text{by-passes attempted}}{\text{total number of by-passes}}$ were computed for each subject and the group mean obtained for each of the ratios. The first ratio was the subjects'by-pass behavior in Programs 1 and 3a combined (before the subjects encountered a review circuit since the first review circuit was at the end of 3a). The second ratio was the subjects' by-pass behavior in Program 3b (after having seen the 3a review circuit). There was no significant difference between the average ratios for before and after seeing a review circuit ($\bar{x}$ before review = 0.63, $\bar{x}$ after review = 0.66). Only four subjects (N=57) showed a substantial increase in proportion of by-passes attempted.

A final analysis was possible because reading scores were available for the 52 subjects. The correlation between reading speed and the pretest was r=+.30; the correlation between reading speed and gain scores was r=+.16; the correlation reading comprehension and pretest was r=+.18 and the correlation between reading comprehension and gain scores was r=+.19. Of these four correlations only the first, between reading speed and pretest was significant, and that at the .05 level of confidence.

Conclusions

Review circuits made no significant difference in the gain scores for Program 3a, but did make a significant difference in Program 3b, $(p < .05)$.

The review circuit increased the average time spent on the program by 50 percent. Since the remedial circuits on the average took much longer and did not improve gain consistently, it is questionable whether they are an efficient addition to branching programing techniques. There was no significant difference between the Review and Non-review groups in the number of errors in diagnostic questions per student per question.

When subjects in both groups were categorized on pretest scores as High, Moderate, or Low, the difference between the groups in gain scores was not significant $(p < .05)$ for any level.

The fact that there was no relationship between the subjects' success in passing the six review questions, and their pretest scores, gain scores, and by-pass errors indicates that the review contributed a new learning experience to the programs.

Discussion

The fact that review circuits seem to be effective in Program 3b but not 3a might be explained by the fact that 3b was a more difficult program than 3a. Thirty-two percent of the subjects in Program 3b needed to review the program content before they could correctly answer the review circuit questions as compared with 18 percent of the subjects in Program 3a. The subject matter of Program 3a was periodicals, and Program 3b on Readers' Guide to Periodical Literature was by its nature more difficult. Breaking down Program 3b into smaller steps would have violated the branching principle that the learner needs challenge. The program was not too hard. Neither could Program 3a be made harder; it used a minimum of steps to cover the subject as it was.

Possibly an analysis of the data by characteristics of individual students would reveal that review circuits are related to these characteristics in conjunction with the difficulty of program.

Another fruitful line of experimentation would deal with the method by which material is presented in the review circuit. For example, performance frames could be introduced in the remedial circuit, or performance frames combined with a "maximum time allotment per question" device could be incorporated in the review questions. Here, the subject who cannot answer a question within a specified time limit would automatically by shunted to a remedial circuit.

The analysis of the six Q levels of success in progressing through the review circuits was hampered and curtailed by the low numbers in Q_3, Q_4, Q_5, Q_6 caused by the bulk of students attaining Q_1 and Q_2. This characteristic of a well-designed program was unavoidable.

The low correlation between success in earning by-passes and success in review circuits was of course an indication of subject ability or the effectiveness of the by-pass qualifying questions. Thus, a subject who failed by-pass questions apparently profited from having his weaknesses pin-pointed and subsequently learned the content in the main line of the program sufficiently well so that he was not tripped up by similar questions in the review circuits.

Although the review circuits increased the average time spent on the program by 50 percent, the correlation between review circuit Q number and time is high ($r=+0.72$ in Program 3a; $r=+0.68$ in Program 3b). Thus, much of this time differential can probably be attributed to the few students who did not know the material well and were circuited into the review summary of the program.

Two samples of subjects were drawn at random from the introductory course in Instructional Materials 417. The Experimental group (N=29) used the program containing the new pictorial diagnostic questions. The Control group (N=30) used the standard program containing verbal diagnostic questions.

PICTORIAL VS VERBAL QUESTIONS

A long-standing anomaly in the use of pictorial materials in instruction is that the learning accomplished by this instruction is tested by a verbal criterion test. This, of course, handicaps the student since in the pictorial instruction he has not learned the verbal terms associated with the information. The obvious solution to this difficulty was to use a pictorial criterion test. However, recent experiments by Magne and Parknäs[14] indicate that group gain scores are facilitated when the same of test is [illegible]. Therefore, a purely pictorial test could be criticized as penalizing the subjects in the Verbal diagnostic questions group just as a purely verbal test could be criticized as penalizing the Experimental group. To meet this objection, the standard criterion test was revised for the present experiment to include both pictorial and verbal questions (18 pictorial and 16 verbal). Examples of the pictorial questions are given in Figure 2. The reliability of this new criterion test, determined by Kuder-Richardson formula 20 was .71. The validity of the test had previously been established by giving it to a group of professional librarians. The face validity of the new pictorial section was checked by a professional librarian. She judged that the validity of the new criterion test had not been decreased by the use of both pictorial and verbal diagnostic questions.

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[14] Olof Magne and Lennart Parknäs, "The Learning Effects of Pictures," British Journal of Educational Psychology, XXXIII, (November, 1963) Part 3, pp. 265-275.

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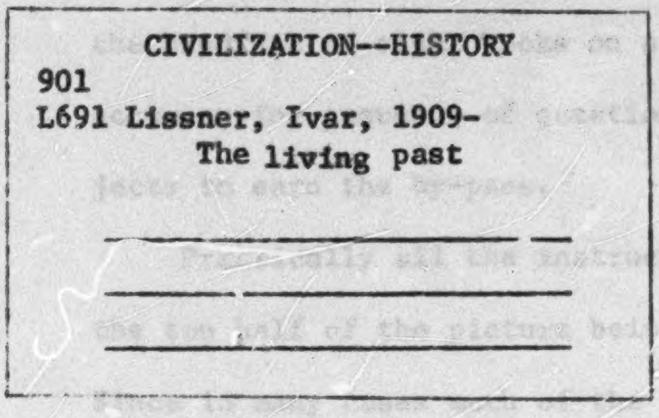
[14] Olof Magne and Lennart Parknäs, "The Learning Effects of Pictures," British Journal of Educational Psychology, XXXIII, (November, 1963) Part 3, pp. 265-275.

FIGURE 2

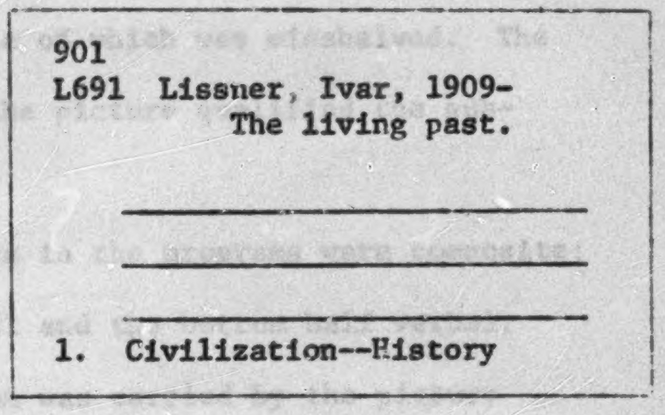
Samples of Picture Criterion Test Questions

15. Which of these is an Author Card?



CIVILIZATION--HISTORY
901
L691 Lissner, Ivar, 1909-
The living past

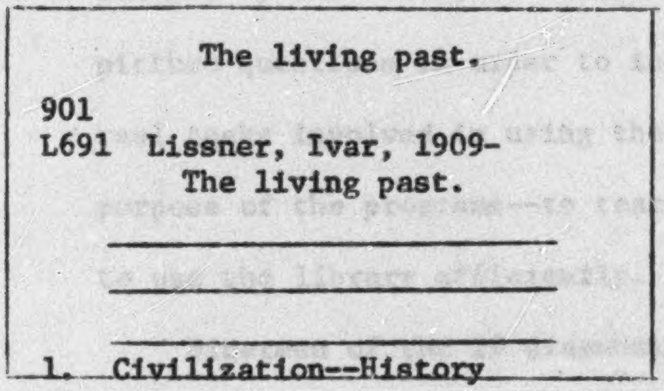
1.



901
L691 Lissner, Ivar, 1909-
The living past.

1. Civilization--History

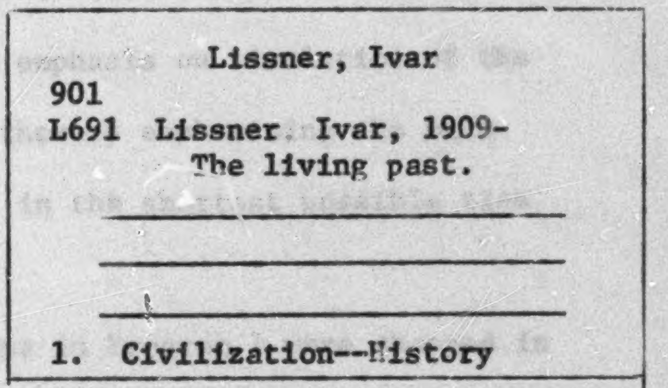
2.



The living past.
901
L691 Lissner, Ivar, 1909-
The living past.

1. Civilization--History

3.

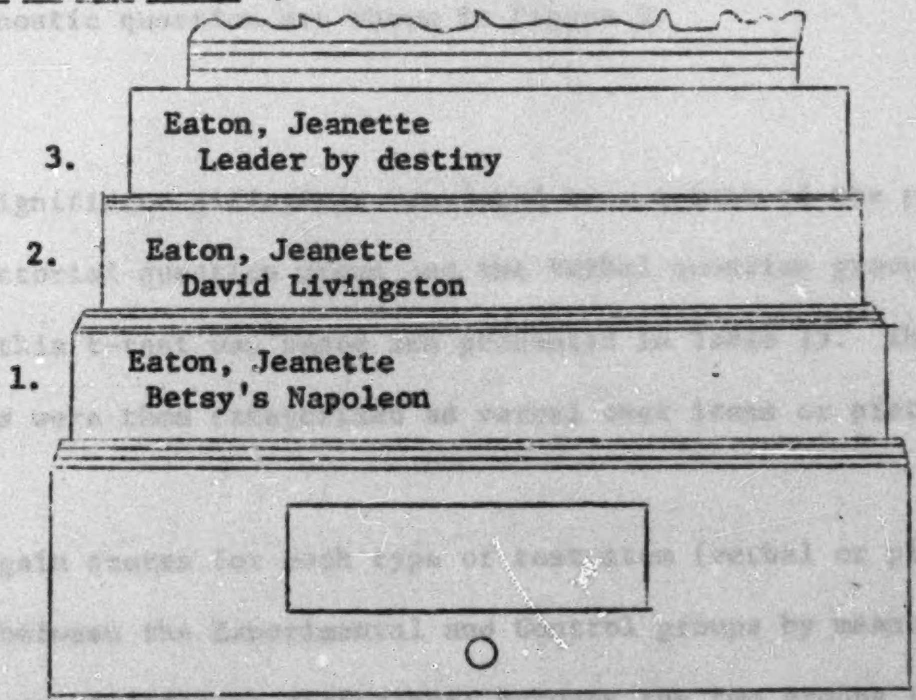


Lissner, Ivar
901
L691 Lissner, Ivar, 1909-
The living past.

1. Civilization--History

4.

18. Following which Catalog Card would you find the card for the book Daughter of the Seine by Jeanette Eaton?


3.
Eaton, Jeanette
Leader by destiny
2.
Eaton, Jeanette
David Livingston
1.
Eaton, Jeanette
Betsy's Napoleon

With one exception all the diagnostic questions in the programs on the use of the university library were verbal. The one exception was a forced by-pass entry question in Program 2, consisting of a close-up of the bindings of eight books on a shelf, one of which was misshelved. The accompanying sequence of questions about the picture qualified the subjects to earn the by-pass.

Practically all the instruction frames in the programs were composite; the top half of the picture being pictorial and the bottom half verbal. Since in many cases much of the information was carried by the picture and not by the words; it seemed appropriate to test the value of diagnostic picture questions in order to increase the emphasis on simulation of the real tasks involved in using the library, thereby emphasizing the main purpose of the programs--to teach students in the shortest possible time to use the library efficiently.

Nineteen of the 29 diagnostic questions in Program 1 were changed in the experimental version to pictorial questions. The 10 remaining verbal questions were not amenable to translation into pictures. The two revisions of a diagnostic question are shown in Figure 3.

Results

No significant difference was found by a t-test of the gain scores of the Pictorial question group and the Verbal question group. The means on which this t-test was based are presented in Table 15. The criterion test items were then categorized as verbal test items or picture test items.

The gain scores for each type of test item (verbal or picture) were compared between the Experimental and Control groups by means of t-test. There was no significant differences between the two groups (Table 15).

Figure 3

Verbal Diagnostic Question

219.

How does a title card compare to an author card?

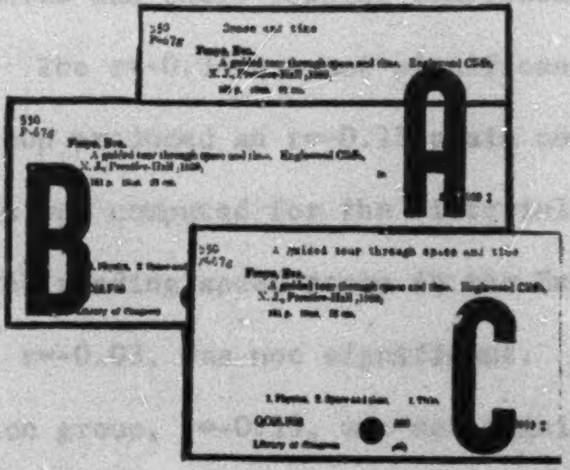
Exactly the same
Go to 221

Printed in capital letters
Go to 220

The same with the title added
Go to 222

Pictorial Diagnostic Question

219.



Which of the above cards is a title card?

If A	Go to 221
If B	Go to 220
If C	Go to 222

TABLE 15

Group Means on Criterion Test

	Verbal Test Questions		Picture Test Questions		Total	
Questions	pre	gain	pre	gain	pre	gain
Pictorial (Experimental)	9.62	4.76	10.41	4.65	20.03	9.41
Verbal (Control)	9.70	4.90	9.87	5.20	19.57	10.10

When the two groups were trichotomized by 3 levels of scores on the pretest, there was again no significant difference between the Verbal and the Pictorial question group mean gains by levels. On the other hand, the mean times of the two groups in going through the program were 35.66 minutes for the Pictorial question subjects and 21.60 minutes for the Verbal question subjects. This difference was significant beyond the .001 level of confidence.

A correlation was computed for the Pictorial question group between subjects' gain scores and their reading comprehension scores on the English Cooperative Test. The r=-0.34 was not significant. A similar correlation for the Verbal group produced an r=-0.13 again not significant.

A correlation was computed for the Pictorial question group between gain scores and the reading speed score in the English Cooperative Test. This correlation, r=-0.03, was not significant. A similar correlation for the Verbal question group, r=-0.19, was not significant.

Conclusions.

The null hypothesis that the Pictorial diagnostic questions would not be an improvement over Verbal diagnostic questions in greater gains on the achievement test was confirmed. This confirmation held whether the result was measured by either verbal or pictorial criterion test items. A similar result was obtained when the subjects were trichotomized by scores on the pretest.

The Verbal group took significantly less time on the program.

Discussion.

In a previous experiment[15] pictorial instruction frames were not significantly better than purely verbal instruction frames as far as their effect on gain scores in the verbal criterion test. However, pictorial instruction frames were shown to be highly significantly better than verbal instruction frames in the performance of actual tasks assigned on the floor of the library as measured by the Performance Rating Scale. It was hoped that in this present experiment that pictorial diagnostic questions would show a similar improvement and it was hoped that this improvement could be measured by the pictorial items of a criterion test. Apparently, the latter was not the case, but the present experiment, not using a Performance Rating Scale gave no evidence as to the effect of pictorial diagnostic questions on terminal behavior as measured by actual performance on the floor of the library. The present experiment needs to be replicated with the addition of the Performance Rating Scale to make this ultimate test on terminal behavior.

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[15] Rust, op. cit., footnote 2.

RISK TAKING

RISK TAKING*

In the first experiment in the first series of these studies, no correlation was found between the subject's willingness to take a by-pass on the one hand and, on the other hand, his SCAT score or his score on that particular subject matter in the pretest. Neither did reinforcement as assessed by behavior following success or failure on a by-pass question appear to be operating as a decisive factor. Similar indications were found in subsequent experiments.

It was hypothesized that perhaps some personality characteristics were related to the subject's willingness to try a by-pass entry question. Therefore, in the experiment on Question Delay the 16 Personality Factor test was administered to all the subjects. A study of the correlation matrix resulting from this indicated that a combination of three factors (M, Q_3, and Q_4) has a weak relationship with by-pass tries. Subsequent experimental groups (Visible vs Blind, By-Pass Entry Frames, and Review Circuits) showed no relationship between these same three factors and by-pass tries.

Speculation as to which personality variables markedly affect choice have led to studies of the relationship between risk taking and intelligence, adjustment, anxiety, social class status, and introversion-extraversion. A most explicit analysis of the influence of a personality variable upon choice in a variety of situations has been made by the McClelland group in relating risk taking and the need to achieve.[16]

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*This study was conducted by Rachel Wendt as part of the requirements for a Ph.D. in psychology under the direction of Dr. Janet E. Rafferty.

[16] Atkinson, J. W. (ed.). Motives in fantasy, action, and society. Princeton, N. J.: Van Nostrand, 1958.

Observations of a general nature have been followed by controlled experimentation using a projective technique for measuring the need to achieve. The theory, supported by a rationale and considerable confirmatory evidence, predicts that individuals characterized by a high need to achieve tend to take moderate risks, while those with a low need to achieve tend to take high or low risks in choice situations where risk is involved.

The research by the McClelland group indicates that experiments which would predict risk taking behavior from levels of need to achieve must meet the following criteria:

1. The task must be relevant to the need involved.
2. The risk must be related to the need involved.
3. Situational cues must be controlled so as to facilitate the arousal of the need involved.
4. The measuring instrument must be a valid measure of the need involved.

Criteria 1, 2, and 3 were satisfied in this study by the fact that the programs involved on the use of the library were a regular assignment in the course Instructional Materials 417 from which the subjects for the studies were drawn. Furthermore, programed instruction itself is a subject taught in this course, and the students understood that going through the three required programs, 1, 3a, 3b, would be their principal assignment in this area. Criterion 4 was satisfied by the instrument used as explained below.

In experiments on risk taking done by McClelland, Atkinson, and others of that group, TAT-like cards were scored for the broad need for achievement.[17]

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[17] McClelland, D.C., Atkinson, J.W., Clark, R.A., and Lowell, E.L. A scoring manual for the achievement motive. J.W. Atkinson (ed.), Motives in fantasy, action, and society. Princeton, N.J.: Van Nostrand, 1958, pp. 179-204.

In recent experiments an expectancy measure has also been used to evaluate the subject's hope of success and fear of failure. However, a different measure from another source of research related to the more specific need for academic recognition was available for the present research. A study by Rafferty[18] had devised and validated a manual for scoring the Rotter Incomplete Sentences Blank for the need value (NV) and freedom of movement (FM) for academic recognition. The terms NV and FM are concepts from Rotter's Social Learning Theory[19] which states that the likelihood of certain related behaviors occurring is a function of (1) the subjective value of the goals (NV) and (2) the expectancy of attaining such goals (FM) in relation to satisfying a given need. Applying the model to this experiment, risk taking in an academic situation would vary depending upon the subject's NV and FM for academic recognition.

While an instrument which had been scored for the relatively specific need for academic recognition was especially appropriate for the present research, the rationale for the predictions was taken from the findings of the McClelland-Atkinson research. However, some modification had to be made in order to allow for the interaction of NV and FM in adapting to social learning theory concepts. Three levels of risk taking were chosen in accordance with the findings of the studies on the need for achievement.

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[18] Rafferty, Janet E. Use of two interpretive projective techniques for prediction within social learning theory of personality. Unpublished doctoral dissertation, the Ohio State University, 1952.

[19] Rotter, J. B. Social Learning and Clinical Psychology. New York: Prentice Hall, 1954.

Procedure.

The purpose of the study was to investigate the relationship between the two independent variables, need value and freedom of movement for academic recognition and the dependent variable, level of risk taking in Program 1 (Card Catalog), 3a (Periodicals), 3b (Readers' Guide). The Rotter Incomplete Sentences Blank-College Form was used to assess NV and FM. The study required that in addition to the ISB, the subjects take a pretest on information regarding the university library and take the program on the use of the library. A total of 75 male[20] students in Instructional Materials 417, a course for juniors and seniors at Southern Illinois University, were the subjects.

The experimental task was divided into two parts. The experimenter administered the Rotter Incomplete Sentences Blank to the subjects without any reference to the second part of the experiment. Instructors in the courses administered to the subjects a pretest on the use of the university library and scheduled the subjects to take programed instruction on the use of the library.

The responses on the ISB were scored for the variables NV and FM as high, moderate, or low for each of the variables. The dependent variable was level of risk taking determined by whether the subjects chose to take high, moderate, or low risks on by-passes inserted into the program. There were nine by-pass choices in the programs, each of which offered the choice of a hard, average, or easy question which would permit the subject to skip an appropriate amount of material if he passed. The by-pass questions had been validated as to level of difficulty. A record was kept of the choices and whether the subjects passed or failed the chosen by-pass question.

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[20] Almost all previous research on risk-taking was on males.

Results.

The effects of previous information as measured by the pretest was found to be non-significant in relation to level of choice of first by-pass. An analysis of behavior following success or failure on a by-pass question indicated that the typical behavior was to persist in one level of by-pass choice regardless of whether the reinforcement was positive or negative. Therefore, reinforcement as assessed by behavior following success or failure on a by-pass question did not appear to be operating as a decisive factor.

TABLE 16

By-Pass Choice Related To The Reinforcement
Of The Immediately Preceding Choice

Total by-pass reinforcements	630	(2 out of a possible 632 were missing)
Behavior of subjects	Number	Percentage
Total pass	371	
Pass and remain	258	.69 e.g. $\frac{258}{371}$
Pass and change to a higher level	95	.26
Pass and change to a lower level	18	.05
Total fail	259	
Fail and remain	170	.66 e.g. $\frac{170}{259}$
Fail and change to a higher level	17	.06
Fail and change to a lower level	72	.28
Total pass plus fail	630	
Pass remain and fail change	347	.55 e.g. $\frac{347}{630}$
Pass change and fail remain	283	.45

The results of TABLE 16 indicate that in 55% or slightly more than half the choices, the pattern followed the predictions according to reinforcement theory that subjects who pass at a given level will remain and those who fail will change. In the remaining 45% of the choices the subjects behaved contrary to reinforcement predictions, with 18% changing following success and 27% remaining after failure. When the data were analyzed so as to compare the subcategories under pass or fail with the total number who passed or failed, in 69% of the cases, the choice remained the same after success and in 66% of the cases the choice remained the same after failure. Therefore, from these data the most likely prediction in any one instance is that the subject will persist in his previous choice, a prediction which is in accord with the point of view of this investigation.

With these factors eliminated as significant influences, chi-square analyses were made of the relationship between the various categories of NV and FM and a three level classification of risk taking. That is, the subjects were classified as high risk takers when they chose the difficult question at least five out of nine times; as moderate, when they chose the moderately difficult question at least five out of nine times; and low, when they chose the easy question at least five out of nine times. The hypotheses, derived from social learning theory and previous research on the relationship between the need for achievement and risk taking, were as follows:

A. When FM is high
   1. NV high = moderate risk
   2. NV moderate or NV low = high risk.
B. When FM is moderate
   1. all levels of NV = moderate risk
C. When FM is low
   1. NV moderate = moderate risk
   2. NV high or low = high risk or low risk or variable from high to low risk

The hypotheses regarding behavior when FM is high or NV low could not be tested because the subjects did not give responses which were scorable for these categories. None of the remaining hypotheses was confirmed.

TABLE 17

Relationship Between All Categories of NV and FM
And A 2-Way Classification of By-Pass Choice

Choice of by-pass	NV-H FM-M	NV-H FM-L	NV-M FM-M	NV-M FM-L
High or Low [a]	(9.78)[b] 9	(7.11) 8	(7.11) 9	(8.00) 6
Moderate	(12.22) 13	(8.89) 8	(8.89) 7	(10.00) 12

---

[a] Predictions and chi-square permit combining these categories.

[b] Numbers in parenthesis are expected frequencies.

Chi-square = 2.11 df = 3 $p < .70$

As indicated in Table 17 when a two-way classification of by-pass choice is made in a 2 x 4 chi-square analysis, the difference between obtained and expected frequencies is no greater than could have occurred by chance and predictions of a relationship between the given personality measures and by-pass choice are not supported. Further chi-square analyses were made to determine if choice of risk would be related to NV when the effects of FM were ignored, or to FM when the effects of NV were ignored.

TABLE 18

Relationship Between NV High and
NV Moderate and By-Pass Choice

Choice of by-pass	NV-H	NV-M
High or Low	17	15
Moderate	21	19

Chi-square = .03 df=1 $p < .90$

TABLE 19

Relationship Between FM Moderate
And FM Low and By-Pass Choice

Choice of by-pass	FM-M	FM-L
High or Low	18	14
Moderate	20	20

Chi-square = .08 df=1 $p < .80$

The chi-square analyses confirmed what seemed apparent from inspection, namely, that by-pass choice was independent of level of NV regardless of FM and of FM regardless of NV.

The three way classification of risk taking presented some difficulty since not all the subjects could be classified according to the criteria and also because it did not take into consideration the choices other than the predominant one. Therefore, risk taking was classified into five categories (high, high-moderate, moderate, low-moderate, and low) in order to give more weight to second and third as well as the predominant choice of subjects. When risk taking was classified into these five categories instead of three, chi-square was non-significant.

TABLE 20

Relationship Between All Categories of NV and FM And A 3-Way Classification of By-Pass Choice

Choice of by-pass	NV-H FM-M	NV-H FM-L	NV-M FM-M	NV-M FM-L
High, Low, and Moderately low[a]	(7.04)[b] 6	(5.44) 8	(5.76) 5	(5.76) 5
Moderately high	(6.75) 7	(5.21) 1	(5.52) 9	(5.52) 6
Moderate	(8.21) 9	(6.35) 8	(6.72) 4	(6.72) 7

[a] Because of inadequate cell frequencies the category Moderately Low was combined with the category Low. As in Table 17 High and Low are combined.

[b] Expected frequencies in parenthesis.

Chi-square = 8.82 df = 6 $p < .20$

However, a difference which was not predicted but which was significant ($p = .02$) was found between the behavior of subjects who rated high in NV and low in FM as compared with those who rated moderate in both variables. This finding suggests that the classification into three levels of risk taking was too limited and that more possible choices should be offered in future studies.

TABLE 21

Relationship Between the Categories NV High and FM Low
Compared With NV Moderate And FM Moderate
In A 3-Way Classification of By-Pass Choice

Choice of by-pass	NV-H FM-L	NV-M FM-M
High, Low, and Moderately Low[a]	(6.32)[b] 8	(6.68) 5
Moderately high	(4.86) 1	(5.14) 9
Moderate	(5.83) 8	(6.17) 4

[a] Because of inadequate cell frequencies the category Moderately Low was combined with the category Low. As In Table 17 High and Low are combined.

[b] Expected frequencies in parenthesis.

Chi-square = 8.40 df = 2 $p < .02$

The problem of the unpredictability of subjects electing to try the questions to earn a by-pass has not been solved by this investigation into risk taking. It was perhaps a little more productive than previous investigations into the relationship of willingness to take by-passes on the one hand with academic ability, previous knowledge of the subject, and the 16 Personality Factors on the other hand inasmuch as one significant difference was found between two pairs of NV and FM in their predicting ability as to the level of risk that the subject was willing to take. This is indeed a modest outcome, but it is a clue which further experiments in risk taking might profitably follow.

Ideally, risk taking should be measured on a continuum such as distances from a stake in trying ring toss. It was obviously not feasible to design a scale of risk taking questions beyond the three levels here used because of the difficulty of designing by-pass questions which would truly discriminate.

Discussion.

In future experiments care must be taken to maintain the need for academic recognition, as was done in this study, by making the programed instruction an integral part of course assignments. The Hawthorne Effect is minimized by this stratagem, and the independent variables NV and FM for academic recognition relatively unaffected by extraneous factors such as may be aroused when the situation is structured as an experiment.

It was unfortunate that experimentation in risk taking as related to academic recognition had not been carried further before it was used in this applied study. Also work with the testing instrument is still in its infancy, and perhaps more positive results could be obtained after the instrument has been further perfected.

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APPENDIX A

Performance Assignments and Rating Scale

Students were given these assignments in the Southern Illinois University Library and were rated by project observers using the Performance Rating Scale.

Do the following library assignments:

A. Show how you would find out if there are any books in the SIU Library on Veterinary Obstetrics.

B. Actually find this book on the shelves and fill out a call card* for it--The Demon Lover.

C. Using the Readers' Guide to Periodical Literature, find out which 1949** magazine contains the article, "The Guy Who Gets Things Done" by Carey McWilliams. Then locate the article itself, that is, actually find the correct periodical and point out the article.

* Morris Library no longer uses call cards as a means of checking out books.

** The year 1949 purposely chosen to make this task more difficult for the student. The articles published in 1949 are found in two different volumes of the Readers' Guide instead of all being contained in one volume.

Date________________Code______________

NAME____________________Class__________

PERFORMANCE RATING SCALE

Score

3	2	1	0	-1	-2	-3

ASSIGNMENT A

when S looks up from reading card

1. Goes directly to Subject Card Catalog . . . . ☐
   - a) Goes to Author-title Card Catalog; quickly catches error. . . . . ☐
   - b) Goes to Author-title Card Catalog; slowly catches error . . . . ☐
   - c) Needs hint. . . . . ☐
   - d) Needs explanation . . . . ☐

   Other (explain)

2. Goes to correct drawer for "see card. . . . ☐
   Goes to correct drawer for main heading . . ☐
   [Check for where S goes first: main heading or "see"]
   - a) Goes to wrong drawer; corrects self . . rapidly . . . . ☐
   - b) Goes to wrong drawer; corrects self slowly. . . . . ☐
   - c) Needs hint. . . . . ☐
   - d) Needs explanation . . . . ☐

   Other (explain)

3. Uses guide cards within drawer accurately to locate section where card he wants is located. . . . . ☐
   - a) Partial use of guide cards--may dip into a wrong section momentarily but goes on from section to section . . . . ☐
   - b) Fumbles through all cards--hard to distinguish any use of guide cards . . . . ☐
   - c) Ignores guide cards at first, finally uses them . . . . ☐

   Other (explain)

when S completes task

4. Finds right catalog cards without trouble . . . . ☐
   - a) Some trouble but finally finds cards himself. . . . . ☐
   - b) Has a lot of trouble but finds cards himself. . . . . ☐
   - c) Needs hint. . . . . ☐
   - d) Needs explanation . . . . ☐

   Other (explain)

ASSIGNMENT B Page 2

Score

		3	2	1	0	-1	-2	-3
when S looks up from reading card	1. Goes directly to Author-title Card Catalog	☐						
	a) Goes to Subject Card Catalog; quickly catches error.		☐					
	b) Goes to Subject Card Catalog; slowly catches error			☐				
	c) Needs hint					☐		
	d) Needs explanation.							☐
	Other (explain)							
when S starts to pull out a catalog drawer	2. Uses alphabetical guides on drawer front correctly	☐						
	a) Goes to wrong drawer; corrects self rapidly.		☐					
	b) Goes to wrong drawer; corrects self slowly			☐				
	c) Needs hint					☐		
	d) Needs explanation.							☐
	Other (explain)							
	3. Looks up correct word in title of book	☐						
	a) Uses wrong word in title; corrects self rapidly.		☐					
	b) Uses wrong word in title; corrects self slowly				☐			
	c) Needs hint					☐		
	d) Needs explanation.							☐
	Other (explain)							
	4. Uses guide cards within drawer accurately to locate section where card he wants is located	☐						
	a) Partial use of guide cards--may dip into a wrong section momentarily but goes on from section to section.		☐					
	b) Fumbles through all cards--hard to distinguish any use of guide cards.				☐			
	c) Ignores guide cards at first, finally uses them.							☐
	Other (explain)							

Page 3

		Score						
		3	2	1	0	-1	-2	-3
when S finds the catalog card(s)	5. Finds both* catalog cards for the book title without trouble	☐						
	a) Finds only one catalog card without trouble		☐					
	b) Finds both catalog cards with some trouble			☐				
	c) Finds one catalog card with some trouble				☐			
	d) Needs hint					☐		
	e) Needs explanation							☐
	Check S's problem: (1) confuses Demon & Demons (2) other (explain)							
	6. Copies down all of call number	☐						
	a) Copies first two lines (not date)		☐					
	b) Copies first line			☐				
	c) Copies first three figures					☐		
	d) Doesn't copy down number							☐
	Other (explain)							
	7. Locates library division using call card or location chart	☐						
	a) Knows division wanted but not where it's located in the library		☐					
	b) Has to think a long time before using call card or location chart; or has to ponder the next step after using card or chart			☐				
	c) Needs hint					☐		
	d) Needs explanation							☐
	Other (explain)							
as S steps into correct library division	8. Heads for book shelves	☐						
	a) Goes to wrong location; corrects self quickly		☐					
	b) Goes to wrong location; corrects self slowly			☐				
	c) Needs hint					☐		
	d) Needs explanation							☐
	Check S's problem: (1) goes to periodical shelves (2) goes to reference shelves (3) other (explain)							

*There are two books with the same title.

Page 4

Score

3	2	1	0	-1	-2	-3

when S starts down the correct row of books

9. Uses guide cards on top of shelf to find correct row of books. . . . ☐
   a) Goes to wrong row; corrects self rapidly . . . . ☐
   b) Goes to wrong row; corrects self slowly. . . . . ☐
   c) Goes to wrong row; needs hint. ☐
   d) Ignores guide cards; needs hint. . . . . ☐
   e) Needs explanation. . . . . ☐

Other (explain)

10. S stays in the correct row of books when he finds it . . . . ☐
   a) Leaves the correct row; corrects self quickly. . . . . ☐
   b) Leaves the correct row; corrects self slowly . . . . ☐
   c) Needs hint. . . . . ☐
   d) Needs explanation . . . . ☐

Other (explain)

when S points to or pulls out the correct book

11. Scans quickly to locate book. . . . . ☐
   a) Scans slowly to locate book . . . . ☐
   b) Realizes himself he didn't write down all of call number. . . . . . . ☐
   c) Doesn't realize at first that he needs to use second row of call number . . . . ☐
   d) Must explain to S that he doesn't have all of call number or that he must use all of call number. . . . . ☐

Other (explain)

12. Fills out call cards correctly. ☐
   a) Omits status. . . . . ☐
   b) Omits date in call number . . . . ☐
   c) Omits status and date in call number. . . . . ☐
   d) Uses only first line of call number . . . . ☐
   e) Any other combination . . . . ☐

ASSIGNMENT C Page 5

when S looks up from reading card

	Score 3	2	1	0	-1	-2	-3
1. S realizes he should look for Readers' Guide.	☐						
a) S has a problem, corrects error himself rapidly.		☐					
b) S has a problem, corrects error himself slowly			☐				
c) Needs hint					☐		
d) Needs explanation.							☐

Checks S's problem:
(1) immediately asks for help
(2) heads for periodical section
(3) heads for division card catalog
(4) heads for main card catalog

Other (explain)

when S finds the Readers' Guide

	3	2	1	0	-1	-2	-3
2. Finds Readers' Guide without help	☐						
a) Knows what R. G. looks like AND it's on tables; doesn't know division		☐					
b) Knows only what R. G. looks like OR it's on tables; doesn't know division			☐				
c) Explain how to find location of R. G. by using Author-title Card Catalog.		☐					
d) Needs hint					☐		
e) Needs explanation.							☐

NOTE: if (a) or (b) is checked, you must also check (c), (d), or (e)

Other (explain)

	3	2	1	0	-1	-2	-3
3. Gets correct Readers' Guide volume first time	☐						
Gets wrong volume first (vol. 16) but realizes he must try vol. 17. .	☐						
a) Gets vol. 16 first but must think very hard before he tries vol. 17.		☐					
b) Gets a volume other than vol. 16 or 17, but corrects himself			☐				
c) Needs hint					☐		
d) Needs explanation.							☐

NOTE: (b) may be checked in addition to (a), (c), (d) or correct behavior

Other (explain)

Page 6

Score						
3	2	1	0	-1	-2	-3

4. Looks up article by author___or subject___first (check which). . . . . ☐
   - a) Looks up author or subject first, doesn't find, so tries title. . . . ☐
   - b) Looks up title first, then tries author or subject. . ... ☐
   - c) Needs hint. . . . . ☐
   - d) Needs explanation . . . . NOTE: check S's behavior in first volume used, 16 or 17 . . . . ☐

   Other (explain)

when S gets up from index table

5. Writes down all necessary information so he doesn't have to return to Readers' Guide. . . . . ☐
   - a) Omits ONE of these: volume, date, page . . . . ☐
   - b) Omits title of periodical . . . . ☐
   - c) Omits volume number AND page, or volume number AND date . . . . ☐
   - d) Omits any other combination . . . . ☐

   NOTE: is S can correctly remember title of periodical without writing it down, it doesn't count against him.

   Other (explain)

6. Goes to Main Card Catalog. . . . . ☐
   - a) Doesn't go to Main C. C.; corrects self rapidly . . . . ☐
   - b) Doesn't go to Main C. C.; corrects self slowly. . . . . ☐
   - c) Needs hint. . . . . ☐
   - d) Needs explanation . . . . ☐

   Check S's problem:
   (1) goes to periodical section of division he's in____
   (2) goes to division card catalog_____
   (3) goes to location chart of dewey numbers_____
   (4) doesn't know how to proceed_____

   Other (explain)

7. Goes to Author-title Card Catalog. . . . . ☐
   - a) Goes to Subject Card Catalog; corrects self rapidly . . . . ☐
   - b) Goes to Subject Card Catalog; corrects self slowly. . . . . ☐
   - c) Needs hint. . . . . ☐
   - d) Needs explanation . . . . ☐

   Other (explain)

Score

3	2	1	0	-1	-2	-3

when S starts to leave the card catalog

8. Looks up title of periodical. . . . . ☐
   a) Looks up wrong thing; corrects self rapidly. . . . . ☐
   b) Looks up wrong thing; corrects self slowly . . . . ☐
   c) Needs hint . . . . ☐
   d) Needs explanation. . . . . ☐
      Check S's problem: (1) looks up author of article_____
      (2) looks up title of article_____
      (3) looks up Readers' Guide _____

Other (explain)

9. Goes directly to correct library division . . . . ☐
   a) S has trouble but finally goes to correct library division . . . . ☐
   b) Needs hint . . . . ☐
   c) Needs explanation. . . . . ☐

Explain S's behavior if (a), (b), or (c) is checked

10. Goes directly to periodicals section in the division library. . . . . ☐
    a) Thinks awhile before deciding periodicals are shelved separately from books; gets correct answer himself . . . . ☐
    b) Doesn't realize periodicals are shelved separately from books or thinks all periodicals are in periodical room only; needs hint to get going. . . . . ☐
    c) As in (b) but needs full explanation . . . . ☐

Other (explain)

11. Looks for periodical alphabetically using title of periodical . . . . ☐
    a) Looks alphabetically using only first letter of title; corrects self ☐
    b) Thinks it's a magazine with a similar title; corrests self . . . . ☐
    c) As in (a) or (b); needs hint . . . . ☐
    d) As in (a) or (b); needs explanation. . . . . ☐
    e) Other problem; needs hint. . . . . ☐
    f) Other problem; needs explanation . . . . ☐
       Check S's problem: (1) wants to use call number_____
       (2) wants to use title of article_____
       (3) wants to use author of article_____

Other (explain)

Page 8

Score

3	2	1	0	-1	-2	-3

12. Looks for periodical by volume number or year rapidly. . . . . ☐
    - a) Looks over most volumes slowly; gets correct volume . . . . ☐
    - b) Pulls out wrong volume on either side of correct volume . . . . ☐
    - c) Pulls out wrong volume not on adjacent to correct volume. . . . . ☐

    Other (explain)

13. Has no trouble figuring out Readers' Guide entried (uses page number to locate article quickly). ☐
    - a) S doesn't understand the R. G. code for ONE of these: vol. number, date, page . . . . ☐
    - b) S doesn't understand the R. G. code for BOTH of these: vol. number and date. . . . . ☐
    - c) S doesn't realize that the title of the periodical is given in the Readers' Guide. . . . . ☐
    - d) S doesn't understand the R. G. code for BOTH vol. number and page or BOTH date and page . . . . ☐
    - e) S has trouble with:
        - (1) vol. number and date and page
        - (2) title and vol. number
        - (3) title and date
        - (4) title and page
        - (5) title and vol. number (or date) and page

      } . . . . ☐

    Other (explain)

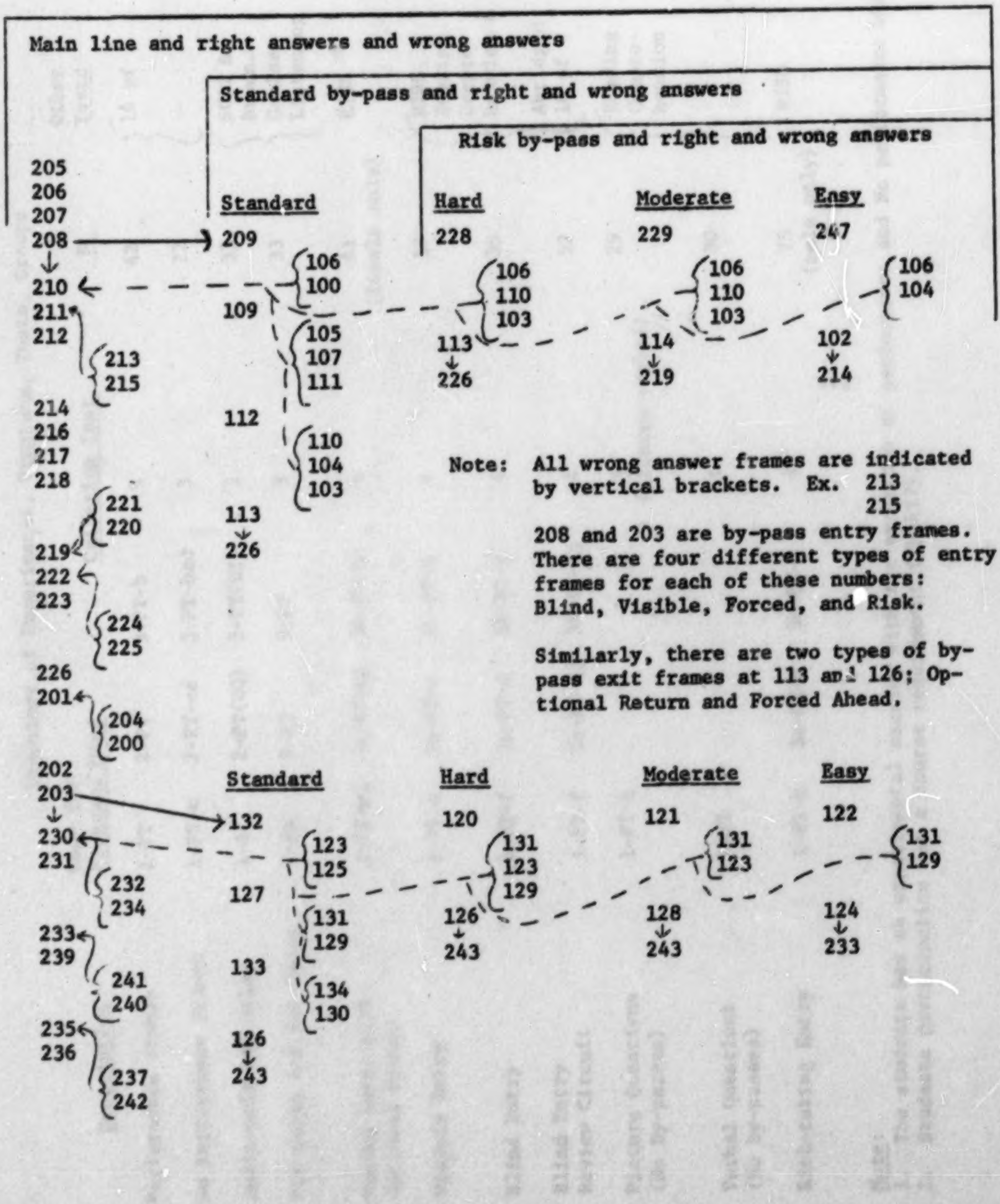
when S finds article and shows it to E

APPENDIX B

NAME______________________________

Time: Start______ End________

SEQUENCE SHEET
Sample Program 3b


Main line and right answers and wrong answers
Standard by-pass and right and wrong answers
Risk by-pass and right and wrong answers
205
206
207
208
210
211
212
213
215
214
216
217
218
221
220
219
222
223
224
225
226
201
204
200
202
203
230
231
232
234
233
239
241
240
235
236
237
242
Standard
209
106
100
109
105
107
111
112
110
104
103
113
226
Hard
228
106
110
103
113
226
Moderate
229
106
110
103
114
219
Easy
247
106
104
102
214
Standard
132
123
125
127
131
129
133
134
130
126
243
Hard
120
131
123
129
126
243
Moderate
121
131
123
128
243
Easy
122
131
129
124
233

Note: All wrong answer frames are indicated by vertical brackets. Ex. 213
215

208 and 203 are by-pass entry frames. There are four different types of entry frames for each of these numbers: Blind, Visible, Forced, and Risk.

Similarly, there are two types of by-pass exit frames at 113 and 126; Optional Return and Forced Ahead.

APPENDIX C

Inventory of Experiments, Programs, Tests, Groups

Description	Code for Programs Used			Criterion Test	N	Other Tests	Group Designation
Performance Frames	1-PT	2-PT	3-PT-b	3	42	16 pf	Performance
No Performance Frames	1-PT-c	2-PT-cd	3-PT-bcd	3	22		No Performance
Audio-only and Delay	1-A	2-PT(DQ)	3-PT(DI)	3	33	SCAT & Brown-Carlsen Listening	B (2)
Pix-Audio and Non-Delay	1-PA	2-PT	3-PT	3	33		A (1)
Forced Entry with Optional Return	1-PT-gl	3a-PT-gl	3b-PT-gl	4	41 (female only)	RISB	Optional Returns
Visible Entry	1-PT-e	3a-PT-e	3b-PT-e	4	37	RISB, Reading Comprehension & Abridged 16 pf	Visible
Blind Entry	1-PT-f	3a-PT-f	3b-PT-f	4	30		Blind
Blind Entry Review Circuit	1-PT-f	3a-PT-fj	3b-PT-fj	4	52		Review
Picture Questions (No By-passes)	1-PT-k			5 (picture-verbal)	29	Reading Comprehension	Pix Q
Verbal Questions (No By-passes)	1-PT			5	30		Verbal Q
Risk-taking Entry	1-PT-h	3a-PT-h	3b-PT-h	4	75 (male only)	RISB	Risk

Note:

1. The students had an experimental session with the exception of performance and No performance which had 2 sessions.
2. Students participation was a course requirement (IM 417).